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ENORMOUS INCREASE IN LAKE COMMERCE.

TWENTY-EIGHT MILLION TONS OF FREIGHT TO AND FROM LAKE SUPERIOR IN 1901, AS AGAINST EIGHT MILLIONS TEN YEARS AGO AND ABOUT ONE MILLION TWENTY YEARS AGO.

Final reports from canal officials at Sault Ste. Marie show a total of 28,403,065 net tons of freight moved to and from Lake Superior during the navigation season of 1901, a period of about 230 days. Of this total, only 2,821,027 tons was moved through the Canadian canal, and the great bulk of that was in American vessels as the commerce in Canadian vessels to and from Lake Superior for several years past has been less than 4 per cent. of the whole. Compare the total of 28,403,065 tons of freight passing the Sault in 1901 with 8,888,759 tons in 1891 and only 1,567,741 tons in 1881 and we have a striking example of the enormous growth of lake commerce. In all important items of freight, excepting soft coal, there is marked gain as compared with last year. The decrease in the soft coal movement is 5 per cent. Following is a summary of the canal statistics (Canadian and United States) for the past two years:

COMPARATIVE STATEMENT OF COMMERCE THROUGH CANALS AT SAULT STE. MARIE, MICHIGAN AND ONTARIO, FOR THE SEASONS OF 1900 AND 1901.

Items.	Seasons. 1900.	1901.	Increase Per cent.
Steamers, number	14,426	14,372	..
Sailing vessels, number	4,004	4,482	12
Unregistered, number	1,022	1,187	16
Total passages, number	19,452	20,041	3
Tonnage, registered, net tons	22,315,834	24,626,976	10
Tonnage, freight, net tons	25,643,073	28,403,065	11
Passengers, number	58,555	59,663	2
Coal, hard, net tons	515,515	804,493	56
Coal, soft, net tons	3,971,462	3,788,643	..
Flour, barrels	6,760,688	7,634,350	13
Wheat, bushels	40,489,302	52,812,636	30
Grain (other than wheat), bushels	16,174,659	24,760,547	53
Manufactured and pig iron, net tons	135,585	206,443	52
Salt, barrels	328,895	443,774	35
Copper, net tons	131,066	98,601	..
Iron ore, net tons	16,443,568	18,090,618	10
Lumber, M. ft. B. M.	909,651	1,072,124	18
Silver ore, net tons	110	.....	..
Building stone, net tons	48,902	46,584	..
General merchandise, net tons	541,397	558,041	3

The United States canal was opened April 26 and closed Dec. 11, 1901; season 230 days.

The Canadian canal was opened April 20 and closed Dec. 21, 1901; season 246 days.

It will be noted that the only items in which there is a decrease as compared with 1900 are: Soft coal, 5 per cent; copper, 25 per cent; building stone, 5 per cent.

The east-bound freight aggregated 23,087,742 tons and the west-bound 5,315,323 tons. In addition to the above traffic 10,100 cords of pulp wood and 9,000,000 ft. of pine logs passed over the rapids bound for lower lake ports.

SHIP BUILDING AT CHICAGO.

Chicago, Dec. 24.—The Ship Owners Dry Dock Co. of this city, of which Mr. C. A. MacDonald is president, has closed a contract with James Corrigan of Cleveland to change the large steel schooner Australia to a propeller. The Australia is 376 ft. long, 48.2 ft. beam by 22.4 ft. depth, and was built by the Chicago Ship Building Co. in 1897. Work on this vessel will be watched with interest by marine men, as this is the first large contract of a steel work kind booked by the Ship Owners company for their works in this city, which are now splendidly equipped. It is hoped by the management of this plant to eventually build up one of the best yards on the lakes, not for repairs alone but for the construction of new vessels. Mr. W. W. Watterson, the general superintendent, who is well known around the lakes, is surrounding himself with a very efficient force of skilled workmen and a capable up-to-date staff. Previous to taking hold here he was with the American Ship Building Co., in charge of the Lorain yard and later at the Buffalo yard.

The Ship Owners Dry Dock Co. has work in view that will keep the yard busy at least throughout the coming year. The plant has been equipped with new and modern tools, suitably located for efficient work in an expeditious manner. No expense has been spared in making new ground for berths and rebuilding the dry docks on the premises at Halsted street and the north branch of Chicago river. Engines to be installed in the Australia will have cylinders of 20, 33½ and 55 in. diameter and 42 in. stroke, to be supplied with steam from two Scotch boilers of 12½ ft. diameter and 12 ft. length.

On Saturday of this week the steamer A. G. Brower, a large steel freighter, will be launched from the Calumet yard of the American Ship Building Co. The Brower is for the United States Transportation Co., of which Capt. W. W. Brown of Cleveland is manager.

At New London, Conn., work on the two large steamships for the Great Northern Steamship Co. is proceeding very rapidly and it is expected that both vessels will be launched during the early summer. It is stated, however, that the construction of the proposed two larger steamships for the same company has been postponed, and work on these vessels will not begin Jan. 1 as was anticipated.

SHIP BUILDING AT PHILADELPHIA AND VICINITY.

Philadelphia, Dec. 25.—Considerable speculation has been in evidence among local ship builders this week regarding the overtures made by the Chilean government for the purchase of the Russian battleship Retvizan. A story was indeed printed to the effect that the newly completed vessel had been so disposed of, but this is emphatically denied both by Charles H. Cramp, representing the builders, and Capt. Eduoard N. Stchensnovitch, the latter president of the Russian inspection board and commander of the Retvizan. Mr. Cramp said that an offer had been made for the battleship, but added that the latter is now the property of the Russian government and can only be disposed of through the usual diplomatic procedure. He believes that there is little likelihood of Russia selling this vessel, which by long odds has been pronounced the best in her navy.

Interesting work will soon be inaugurated at Cramps ship yard in the laying of the keel for the cruiser ordered by Turkey one year ago. A few days ago the ship building company directed its European representative to inform the Turkish minister of marine that it was ready to begin the preliminaries, and asked for an inspection board to supervise the construction. If the present plans are adhered to the new cruiser will be of about 3,200 tons, corresponding to the Charleston class in the United States navy. She will be 300 ft. long, 42 ft. beam and will be built for a speed of 22 knots an hour. There will be a main battery of 8 and 6-in. guns and a powerful secondary battery. The time limit clause is understood to have been eliminated from the original contract signed in Constantinople last Christmas day.

The national harbor refuge, otherwise the new Delaware breakwater, which has been in course of construction for almost five years, was finally completed yesterday. Hughes Bros. & Bangs, contractors, so reported to the government station at the capes and the report was later posted in the Maritime exchange. The immense stone wall, 41 ft. thick at low water and 20 ft. thick at flood tide, now extends 5,725 ft. across the mouth of Delaware bay, and affords a safe anchorage area of 700 acres. Hughes Bros. & Bangs, whose bid was $1,638,795.33, were awarded the contract by the government on Feb. 5, 1897. According to the terms, 280,000 gross tons of stone were deposited yearly, the aggregate amount required for the wall being 1,384,000 tons. Congress in 1900 appropriated $30,000 for a light house on the breakwater.

Scarcity of cars causes lack of sufficient coal to supply cargoes for vessels in port. At the offices of the Pennsylvania railroad it was said that the mines are turning out as much coal as usual. The demand for coal, it was added, is greater than the supply. The freight rates for schooners carrying coal to New England ports still remains high. To the other side of Cape Cod $1.20 per ton is the quoted rate, while $1.00 to $1.10 per ton is given for voyages to ports this side of the Cape.

With a view to improving the facilities for instruction in naval warfare, vessels are being refitted for this specific purpose at the League Island navy yard. The first man-of-war to go away will be the monitor Terror, assigned to the naval cadets at Annapolis for instruction in gunnery and operation of turrets in coast defense. Cruises along the coast will be made from Port Royal to Buzzard's bay. The monitor Puritan, originally assigned to this service, will be withdrawn, and will go in reserve for the North Atlantic squadron at Norfolk.

The British steamship Kinsman sailed from Marcus Hook for Europe a few days ago with a cargo of 2,200,000 gallons of refined petroleum. The vessel is of the following dimensions: Length 373 ft., breadth 49 ft. 9 in., depth 30 ft. 6 in., and is capable of carrying 6,500 tons. The importance of the oil export trade from this port is shown by the quantities shipped from the Marcus Hook and Point Breeze refineries during the present year. Since January 1,373,340,494 gallons of crude and refined petroleum have been loaded on vessels. This shows a gain of 68,532,606 gallons over that of the corresponding period of last year. The development of the Texan oil trade promises to add materially to both the export and domestic trade. The J. M. Guffey Petroleum Co. continues active in its search for suitable carriers and every few days succeeds in adding some small vessel to its growing list.

Organized labor in Philadelphia through its representatives in the central bodies will petition congress to enact and President Roosevelt to sign a law providing that battleships and other government vessels shall be built in ship yards operated by the government. Secretary Edward M. Brown of the Council of the Allied Building Trades has forwarded the general petition. Many local petitions will be prepared and circulated. These are part of a national plan to impress upon congress the demand for such legislation. Such a law would seriously affect the yards of Cramps and Neafie & Levy of this city and the New York Ship Building Co. of Camden, which employ an aggregate of 10,000 men. Among reasons advanced by labor leaders in favor of this law is the double advantage of the eight hour day and the higher wage enforced by governmental regulations.

The Japanese Society of Naval Architects has had a most successful annual meeting in Tokio. The society consists of some 370 members including the inspector-general of naval construction (Mr. Sasso) and other officials of the admiralty staff, the chief officials of the Imperial dockyards, the professors in the engineering college of the Imperial university (the curriculum of which includes naval architecture as one of its important courses), and several private ship builders. The papers read at the meeting were: "The Docking of Battleships," by Commander M. Asaoka, a chief constructor to the Imperial navy, and at present on the admiralty staff; "Refrigerating Plant," by Com'dr I. Takakura, a chief engineer constructor on the admiralty staff; "The Relation which should exist between the Naval Architect and the Seaman," by Capt. T. Hirayama, director of the mercantile training school, Tokio; and "Floating Docks," by Dr. I. Ishiguro, chief of the technical staff of the bureau of naval extension. The proceedings were entirely in Japanese.

ST. LAWRENCE SEASON A POOR ONE.

A dispatch from St. John's, N. F., is to the effect that the season of navigation of the St. Lawrence, which has just closed, has been the poorest in the history of the route for many years. In the number and tonnage of ships and in the value and extent of the cargoes the shortage has been considerable, and there is much dissatisfaction at Montreal. In the matter of wrecks and groundings, also, the situation has been most unfavorable for the losses to insurance companies have been the greatest in twenty years. All the total wrecks have occurred on the Cape Race peninsula, the southeast coast of Newfoundland, while the lesser disasters took place in the St. Lawrence river and gulf.

Cape Race has nine complete wrecks to its discredit this year—eight steamers and the large steel barkentine Titania. Of these, six ships were in the St. Lawrence trade, and the value of hulls and cargoes was at least $2,000,000. The groundings were sixteen in all, one of them being that of the British warship Indefatigable. The cost involved in these mishaps will approach another $1,000,000 for the underwriters, while the British admiralty will be out of pocket $135,000 through the stranding of the warship, which was so badly damaged that she could not cross the Atlantic to enter an imperial dockyard, but had to be repaired at Halifax. The Canadian shipping interest has been agitating for a reduction of the insurance premiums, which are now levied upon the St. Lawrence route at a much higher rate than is enforced against the American ports. But in the face of this casualty list it is not surprising that the agitation fails to effect anything. Insurance underwriters allege that their operations in the St. Lawrence the last ten years have resulted in an annual loss to them of over $1,000,000 above the premiums received, and for their own protection against a continuance of such a state of things they have felt themselves obliged to advance the rates.

The marine insurance rate is 4 per cent. to New York and Boston, as against 9 or 10 per cent. to Montreal. This makes a difference of $5,000 to a vessel in favor of American ports, and as the vessels going to Montreal make only about five trips each season it puts the port of Montreal under a disadvantage of $25,000 for the season for each vessel that plies there. The adoption of remedial measures is earnestly urged. These are, chiefly, the providing of coast aids for the Cape Race region, the establishment of a better lighting system along the waterways giving access to the gulf, better charts and a hydrographic survey of the river and approaches, and a reorganization of the pilotage system.

The wrecks about Cape Race are due almost wholly to the fog which envelops the coast and, together with the variable currents, lures ships to their ruin. Not a year passes without one or more shipwrecks in this vicinity, but the last season has been exceptionally disastrous. The great need is for powerful fog signals on the headlands, with whistling buoys on the shoals. The Newfoundland government, while willing to do its share toward safeguarding the coast, does not feel itself called upon to provide such costly appliances as the needs of Canada's shipping would require, for the local craft never come to grief there.

As regards the gulf navigation there is much complaint in Canada, and among shipping men especially, over the defective lights and signals and the lack of a modern hydrographic survey. The great majority of the accidents occurring are due to these causes, assisted by the wretched pilotage system in the river. Bad pilotage caused the mishap to the warship Indefatigable, which was proceeding up to Montreal from Quebec. The same cause sent the Montfort ashore in the same channel, outward bound with a full general cargo. The consensus of opinion in shipping circles is that Canada can never hope to have the river and approaches safely navigable until she has spent millions of dollars on improvements. A great need is a wider and deeper channel in the river. Montreal has only a 25-ft. channel safely navigable, and the demand now is for a 30-ft. one 500 ft. wide. This will, it is expected, cost at least $2,000,000, and to perfect the lighting and fog alarm services with a survey and new charts will call for another $1,000,000 at least. The Dominion government hesitates to undertake this outlay, but the falling off in Montreal's commerce this year is expected to stir up action. Within the last four years the decline in Montreal's shipping has been most marked, being almost 25 per cent. as the appended figures show:

YEAR.	VESSELS.	TONS.
1898	516	1,212,747
1899	434	1,092,955
1900	416	1,038,234
1901	396	988,078

This deals with steamships only, but the tonnage of sailing vessels has also been considerably less.

The western grain traffic, from Manitoba and the adjoining districts, has been diverted largely to American ports, owing to the fact that the Montreal season is so short and ends so abruptly, that the grain harvest cannot be transported to tidewater in the St. Lawrence before the river freezes. And Montreal lacks good elevators where grain could be stored for the winter at such cheap rates as would make it worth while for western handlers to ship there and await the opening of spring, when a fleet of tramp steamers could load at once if reasonable insurance on freights and hulls could be secured. But as it is there are no adequate storage facilities, and the grain finds an outlet to market through Portland, Boston and New York, where ships can load all the year round. This year the Dominion, Johnston and other lines withdrew from Montreal altogether and established themselves at Portland, giving Canadian passengers free railway transportation to the latter city so as to hold the trade. It is feared that other lines will adopt the same policy ere long, unless the difficulties in the way of the St. Lawrence are removed, for, apart from the lowering of the insurance, there is an absence of the excessive risk associated with the more northern route. As the population of Manitoba grows and its production of wheat increases, the need for Canada to provide an adequate and efficient route for her own grain products becomes greater and the ill effects of delay are intensified.

The Jupiter Steel Co. of Pittsburg has decided to erect large branch works at Norfolk, Va., and has purchased about fifteen acres of land for this purpose. The company operates under patents owned by the United States Steel Co. of Boston. Texas fuel oil, supplied by the Texas Oil & Pipe Line Co., will be utilized at the Norfolk plant.

THE PASSING OF A GREAT SHIP BUILDER.

Sir William White has definitely resigned as chief constructor of the British navy and Mr. Philip Watts, of Armstrong, Whitworth & Co., has been appointed to succeed him. Sir William White's retirement marks the passing of the greatest ship builder, measured by achievement, of the age. His career has been a most remarkable one. He is fifty-six years of age and joined the government service when he was twenty-two. For ten years he acted as professor of naval architecture at the Royal Naval College. He filled the important post as designer to the Elswick ship yard, and at a considerable financial sacrifice accepted the post as chief constructor to the navy when thirty-eight years old. He created the British fighting fleet as it exists today. Since he accepted office a fleet of 212 ships has been designed, exclusive of the small torpedo craft. This fleet represents in all 1,419,000 tons, and in association with his friend and colleague, Sir John Durston, the engineer-in-chief, he has seen 2,230,000 I.H.P of machinery prepared for this fleet. In these figures there are forty-two battleships, including the splendid vessels of the classes known as the Royal Sovereigns, Majestics, Canopus, Formidable, Duncans, Queen and the recent King Edward VII., now prepared for giving out to contract. These battleships make up 597,700 tons displacement and the collective power of the machinery is 621,000 I.H.P., the cost being over £42,000,000.

With the assistance of armor plate makers Sir William White entirely changed the type of first-class cruisers and many of these may now take their place in line of battle. Before his appointment the largest cruiser was under 7,000 tons; now they are from 12,000 to 14,000 tons. The twenty-six armored cruisers which he has designed make the great total of 285,000 tons with a collective power of 580,000 I.H.P. or nearly 2 I.H.P. per ton, while formerly the ratio was little over 1 I.H.P. per ton. He built twenty-one first-class cruisers ranging from 7,700 tons to 14,100 tons, the total being 203,700 tons and the power 384,000 I.H.P. Many of these ships of the earlier days were only of 19½ knots speed, for he ceased the policy of pinching the engine designer in the matter of weight. Later with water-tube boilers it has been found practicable to get 23 knots. His second-class cruisers number fifty and represent 230,000 tons and 452,000 I.H.P., while seventy-three smaller ships—third-class, cruisers, gunboats and sloops—make up a total of 212 ships, a mighty fleet for sixteen years service.

NEW COAL PORT FOR LAKE ERIE.

While the plans are not as yet sufficiently prepared for publication, arrangements have proceeded far enough to say that a new port will be established on Lake Erie at Richmond, opposite Fairport, O. A syndicate, of which Calvary Morris and H. A. Garfield of Cleveland are the managers, is furthering the enterprise. The port will serve as the lake terminal of a new coal road which the syndicate is projecting to Wheeling, W. Va. Considerable progress has already been made upon the railway and the work is being steadily pushed. The new road will, when completed, be a consolidation of existing lines with considerable new track. Constructive work is at present under way on the railway between Hopedale and Bergholz, a distance of 18 miles. When this is completed existing lines will give it entry into Phalanx from Wheeling, W. Va. The distance from Phalanx to the lake is fifty miles and the land is now being surveyed for the railway. No date has been set to begin construction of the dock at Richmond, but that there will be another coal shipping port on Lake Erie is definitely established.

PRACTICAL MARINE ENGINEERING.

Mr. W. F. Durand, professor of marine engineering at Cornell university, has just issued a book entitled, "Practical Marine Engineering." The book is a thoroughly practical work. Each topic is illustrated in detail so that the descriptive matter is very fully explained by reference to drawings taken from representative examples of recent practice. It can thus be said that all the essential features of the propelling machinery of a ship, with auxiliaries, are illustrated and their functions are described in plain and simple language. The book does not attempt to cover the subject of marine design, but simply describes marine machinery as it is and in such a comprehensive manner and so clearly that any student may understand. In addition to the constructive side, special attention is given to the subjects of operation, care and repairs. A special chapter is given to the discussion of various problems of importance for the marine engineer. Some of these are elementary, while others include topics which will be of interest to those already familiar with elements of the profession. Among those special topics may be mentioned the following: Steam boiler economy, steam engine economy, coal consumption and related problems, the lever safety valve and the safety valve problem, the boiler brace problem, strength of boilers, loss by blowing off, gain by feed-water heating, indicated thrust, reduced mean effective pressure, work done by pumps, computing weights of parts of machinery. In order to make the book as valuable as possible to the men who have not had the technical training which well-educated students have had, a series of questions is added covering with great completeness all subjects discussed. The book may be had from the Marine Review Publishing Co., Cleveland, O., at $5 per copy.

It is stated that provided nothing unexpected hinders the Johnson Iron Works and the McLellan and other docks of New Orleans will be bought up by a syndicate of northern capitalists, whose representatives are now in New Orleans, and used as the nucleus of a modern ship building plant and system of dry docks. A similar plant will be built at Mobile. The people of New Orleans will be asked to underwrite an issue of $250,000 in bonds. The representatives in New Orleans are: Charles M. Jessup of New York, president of the Gulf Coast Ship Building & Dry Dock Co.; Cassius M. Wickers, vice-president of the company of H. B. Hollins & Co., New York brokers; Samuel B. McConnico of New York, second vice-president and secretary; Robert C. Morris of New Orleans and New York, third vice-president and treasurer; James U. Jackson, financier, and general agent of the Seaboard Air Line, of Augusta; John Watters of New Orleans, formerly lieutenant, United States navy; C. P. E. Burgwyn, ship builder of Richmond, Va.; Henry Konitsky of Philadelphia, formerly superintendent of hull construction at Cramps' ship yard; R. M. Jessup, mining engineer, and son of President Jessup.

LIQUID FUEL ON STEAMSHIPS.

While the subject of liquid fuel is by no means a new subject, at least not in the United States where it has been more or less in vogue for several years, nevertheless it has revolutionary possibilities which impel technical papers, particularly in Great Britain, to pay much attention to it. Lately a number of distinguished ship owners inspected the Clam of the Shell Trading & Transport Co. which has been equipped for the past two years with liquid fuel burners. Fairplay of London, describing the vessel, says:

"The vessel was lying off Gravesend with her steam up, and it must be admitted that on boarding her no one required to be told that liquid fuel was to the fore. The smell of petroleum was unmistakable, but it was by no means overpowering, in fact in a short time one ceased to notice it at all. There was but little smoke from the funnel, less perhaps than with the best Welsh coal, and there is no apparent reason why the combustion should not be still further improved, so doing away with smoke altogether. Large plans of the tanks, feed apparatus, etc., were exhibited, and were closely studied by the engineers, but it was in the stokeholds that the great surprise to visitors was to be found. One Chinaman was walking about with the calmness peculiar to that remarkable race; the floor was clean, there was no smell of any kind, no noise, no dirt; and the air was just warm enough to be welcome on a day when a biting north wind was making the deck anything but a pleasant place for a lounge. The contrast with the stokeholds of even the best appointed liners was nothing less than startling. The Shell line employs Chinese hands and finds them docile, industrious, and quiet, besides being in every way efficient.

In this connection it is pertinent to note that the Standard Oil Co. had made overtures for the taking over of the Shell line and there is every evidence that the negotiations will be successful.

The talk of Sir Marcus Samuel of the Shell company upon the performance of the Clam is quite an important contribution to existing knowledge upon the subject of fuel oil. He did not know of any more serious matter to the progress of the mercantile marine than that of liquid fuel. They were then assembled on board a steamer which had been running continuously for two years under liquid fuel. She had just delivered in London a cargo of oil from Borneo. As they now saw her she was about starting on a voyage across the Atlantic, and beyond the few festive decorations she had not been altered in any way from her ordinary trading condition. Many of their visitors that day had doubtless been in the stokehold, and they could not fail to have been struck with what they saw there. They saw forty or fifty gentlemen in the stokehold at one time, and the least observant among them must have noticed that if coal had been in use room could not possibly have been found there for so many visitors. When they also bore in mind the conditions of labor when liquid fuel was in use he thought their visitors must have had brought home to them very forcibly the great future there was for this fuel, because many of the gentlemen he was now addressing would know only too well that one of the greatest troubles which British steamship owners had to contend with today was connected with the labor in the stokehold. It was notorious, he was afraid, that in the Atlantic trade firemen often came on board in a condition that was pitiable in the extreme. He knew of one case in which if the firemen could be induced to get 300 tons of coal through the stokehold the ship could do 20 knots. But this speed was impossible simply because the stokers would not do more than 260 tons, and in consequence a speed of only 18 knots could be obtained. By the use of liquid fuel this labor trouble disappeared, and another and a further great point in its favor was that under no circumstances did they drop their steam. They dispensed with the human element, and maintained a regular rate of speed. The Shell company had eighteen steamers running under liquid fuel, and in every one of these cases they had this remarkable feature, that the ship was doing a speed which she never could do with coal. They had run the Clam 13 knots under liquid fuel, and they had got quite a knot more out of her than under coal. Where a steamer had to bunker at different ports, and obtain coal differing immensely in quality, it was very difficult for the engineer in charge to know exactly what bunkers to ship. With oil he knew to an absolute fraction of a pound what horse power a ton of oil would give, and the practical engineer was thus able to estimate his requirements with accuracy. Yet another advantage by the use of liquid fuel was that they were able to carry it in the ballast tank, so that the whole of the bunker space was available for cargo, and that, in a ship like the Clam, represented 400 tons of measurement cargo. Again on a big liner they carried 160 stokers. By using liquid fuel they might dispense with 140 of them, so that the room at present occupied by this number became available for steerage passengers. It stood to reason, however, that the owners of fleets of steamers who might be disposed to employ liquid fuel wanted to be quite assured of the regularity and continuity of the supply, and at a price that would compete with coal. Ten years ago, when the Shell fleet was started, he found in the late Sir William Gray, the head of the famous ship building firm of West Hartlepool, a congenial spirit, a man who saw eye to eye with him in this matter. The late Sir William said to him "Samuel, you are right; I can see what you say is perfectly correct. It is going to come, and I will join you." Sir William Gray did join them by assisting them financially, because the building of such a fleet as the Shell line could not have been accomplished by a single individual, and from Sir William Gray they received very great help and encouragement. He (Sir Marcus) and those acting with him were almost deemed madmen when they built the Clam. No one apparently then thought that it would pay to build a steamer to carry 4,500 tons of oil in bulk, but the growth of this trade had since been very instructive, because immediately after completing this steamer for 4,500 tons they built one to carry over 5,000 tons, which was followed by steamers each having capacity for 6,800 tons. At the present time the Shell company had four steamers each of which carried 9,000 tons, and they were building four more each of which would carry 11,000 tons. These facts were his justification for saying that his company had succeeded. The credit for the first success in the use of liquid fuel was due to a British company, for the Shell company was a British concern. They had not been followed, however, as he could have wished by other British undertakings, but by the North German Lloyd, the Hamburg-American company, the East Asiatic company of Copenhagen, and finally by the China Mutual. Liquid fuel had been looked at askance hitherto, but he thought that now it was going to be believed in. When they considered that there were 7,000,000 tons burnt on Russian railway lines, that the use of the oil was universal on the Caspian Sea and the Volga, that American railways were today adopting it as fast as they could for their locomotives, and that in England the Great Eastern Railway Co. had been using it for years past, he remembered with some sorrow that some British railway companies had been so misguided as to refuse to allow his company even sites for tanks for the storage of the oil. There was, of course, a reverse to this picture, because at Dover they had had strenuous offerings to induce them to go there, while the London & Brighton Co. had begged them to put up tanks on their line, and said they would use the oil in their locomotives. But the lot of the pioneer was a hard one. He had great prejudices to overcome, but common sense at last prevailed. The demand, however, then came with such a rush that the difficulty was to cater for it. But difficulties only existed to be overcome, and the prediction he ventured to make three years ago had been fully verified. He was then asked, "How are you going to get a supply of liquid fuel for the whole world?" It was admitted that there was a supply for the eastern hemisphere. "But how," he was asked, "are you going to supply the western?" He ventured to reply that he was quite certain that the demand would create the supply, and so the result had proved. It was notorious that there had been rich finds of oil in Texas, and the Shell company now had one of their steamers within seven days of London laden with 8,000 tons of oil from the Texas fields. Therefore there was no reason to anticipate for one moment that the supply of oil would fall short of the demand, whatever that demand might be. The company which he had the honor to preside over was a highly prosperous one. It had a capital of two millions sterling, and in three years they had put aside to reserve and depreciation something like £700,000. He simply mentioned these circumstances to satisfy those gentlemen with whom they might have negotiations that they would not be trading with any bogus concern, and that any contract undertaken by this company would be fully carried out.

The Clam has just reached this country for a cargo of oil and is at present in Philadelphia.

NEED OF DIRECT SERVICE TO AFRICA

Peter Strickland, consul to Goree-Dakar, Africa, has just sent to the state department at Washington a plea for a direct steamship service to Africa. He recounts the fact that Africa is being exploited by mercantile companies which, being European, are naturally inimical to American interests. This was not always so. Only a few years since (in the days of sail) Americans had the same rights in the African colonies as others and were not backward in exercising it. How is it, then, he asks, that they have so quickly lost all, or nearly all? In his opinion it is simply because they have as a nation neglected their ocean carrying trade and allowed unsympathetic foreigners to attend to what should have been their own first business. Continuing, he says:

"Previous to 1870, the west coast of Africa was connected with Europe, as well as with America, principally by sail, and as long as this state of things existed Americans held their own in Africa, and had perhaps, all things considered, their full share of its budding trade. The American flag was then never absent from the coast. American goods were known everywhere and liked, and fortunes were made by Americans doing business in this way. But the advent of steam has changed all this. The French government first heavily subsidized the Messageries Maritimes Co., in order to have the large and fine steamers which ply fortnightly between Bordeaux and Brazil stop at Dakar. The Transport Maritime line from Marseilles followed, its steamers also making fortnightly trips. Then came in quick succession the Chargeurs Reunis line from Havre, the Fraissinat line from Marseilles, and the Ligne Mixte. Cables were laid along the cost of Africa to facilitate the business of these government-assisted lines, and sail almost disappeared from the coast. The great Elder Dempster company of Liverpool also established a fortnightly service between Liverpool and this part of the coast, and the Woerman line of steamers from Hamburg kept the interests of the German merchants and manufacturers on as sure a footing as the others.

"With all these first-class facilities for commerce, Americans, by sail and without subsidies, could of course not compete. So after keeping up a running fight for a few years with tobacco, petroleum, pitch-pine lumber, and a few other articles peculiarly American—until Europeans themselves began to bring the two former by steam in quantities as wanted—the American merchants were obliged to own themselves beaten, and one by one their vessels were withdrawn from the trade. Tens of thousands of tons of goods, with which Americans could successfully compete if they had steamers of their own, are being distributed here, but in the midst of all this activity, no one could tell from appearances that such a country as the United States exists. I see scores of European steamers coming and going, loading and discharging almost every week, but during a residence of more than twenty years in the country, I have never yet seen an American merchant steamer in African waters. Here are railroads being built and equipped, millions of natives being clothed and otherwise provided with the appliances of civilization, wharves, bridges and docks being constructed, and electric plants and appliances being introduced, while we are taking no part in the furnishing of all these things.

"But it may be asked, if the trade of Africa is so desirable, why did not the American merchants who formerly did business here and used sail for transport, organize steam lines like their European competitors for the continuation of their business? To answer this question it is only necessary to say that, as Americans have not thought themselves able to do it with the old countries on the east side of the Atlantic, nor with South America, how can it be expected that they should succeed in such an enterprise where the conditions would be more difficult? The 150,000,000 people in Africa do not need our bulky grain, nor our cotton, nor our animals, either slaughtered or on the hoof, but they do need our flour, our biscuits, our Indian-corn meal, our cotton goods, our hams, preserved meats, fish, vegetables, boots and shoes, tools, machinery and locomotives, with hundreds of other things I need not mention, nearly all of which are now furnished by Europe, even though the country of their origin be the United States. What is needed is the means of getting our goods here under American control."

For navigation charts apply to the Marine Review.

DEVELOPMENS IN CARGO-BOAT MACHINERY.

BY BENJAMIN TAYLOR, GLASGOW.

It is just 136 years since James Watt was taking a Sunday afternoon stroll in the only public park which Glasgow then possessed, "The Green," when the idea of the separate condenser suddenly occurred to him. The problem with which he had been so long wrestling was solved, and the steam engine was born. In 1769 it was patented, and in 1774 the historic engine works of Bolton & Watt were founded. The story of marine engineering in Great Britain, however, begins in 1812, in which year was designed the Comet, whose hull was built by John Wood & Co., Port Glasgow, and whose engine was of 3 H.P., built on the bell-crank principle designed by James Watt. The history of marine engineering, therefore, began in Glasgow, eighty-nine years ago. The purpose of this paper is not to follow the history of that industry, but to trace some of the developments in the marine engine during the last quarter of the last century.

As was indicated recently by Dr. Robert Caird in his address to the Institution of Engineers and Ship Builders in Scotland, the most striking advance in marine engineering has been in the gradual rise of steam pressures, accompanied by the adoption, first of the compound, and then of the triple and quadruple-expansion engine. The rise has been from 20 lbs. per square inch to 180, and even 250 lbs., with the result that engines and boilers are now working as satisfactorily at these higher pressures, and twice as economically, as at the lower. Other accompaniments of increased pressure have been successive improvements in material, construction and design; piston speed has been doubled, and the speed of revolution increased eight fold. The type of boiler has changed from the tank to the circular or Scotch, which has held its own, although, as some think, it has nearly reached its limit of efficiency, and, at any rate in the navy, has given place to the water-tube type. Reduction of nearly one-half in weight of engines has been effected by improved design following upon a correct determination of stress, by the use of stronger material, such as mild steel for iron, and gunmetal for cast iron in condensers, etc., and further by the great development in machine and other tools. Corrugated furnaces in boilers, evaporators and distillers, metallic packing and asbestos-pack cocks evolved as the need for them arose. An important feature in engine design has been the separation of many organic parts, such as pumps, from the main driving engine, and the multiplication of the application of power. Within fifty years in the navy auxiliary engines have increased from eight in number of 146 I.H.P., to about 300 of 3,000 I.H.P., in a single ship. In naval architecture a very marked feature has been the growth in the dimensions and weight of ships. On the Atlantic route the speed has increased in sixty years from 8½ to 22½ knots, and the time occupied on the passage is about one-third of what it was. Ships, in the interval, have trebled in length, doubled in breadth, and increased ten fold in displacement. The engine power is forty times as great, and the ratio of horse power to weight driven is four fold, while the rate of coal consumption is only about one-third. The achievements of Mr. Parsons with the Turbinia and the Viper may be said to surpass all.

But what we particularly want to look at is the development in cargo-boat machinery.

It is on record that Stephenson saw a boiler worked at 138 lbs. pressure on board an American steamer on the Ohio river before the close of the first half of the century we have just left behind us. This is usually regarded as the first example of high pressure. However that may be, we date the era of high pressure and multiple expansion in the seventies. Perhaps the Propontis may be taken as the first example of it in a Clyde-built vessel. This was a steamer built and engined in 1864 by the firm of Randolph & Elder, the founders of the great establishment now run under the name of the Fairfield Ship Building & Engineering Co., Ltd. Whatever was her first machinery, she was refitted with triple-expansion engines in 1874. She was at the same time fitted with new boilers of the water-tube type, which proved a failure, and were two years later replaced by cylindrical boilers working at a reduced pressure of 90 lbs. With these boilers the vessel ran until 1884, when she again got new boilers, which worked up to 145 lbs. pressure, still with the 1874 engine. Now this may be called a development in boiler making rather than in marine engineering, but it is well to recall that an eminent naval architect (Dr. Kirk) declared that it was really the want of a proper boiler that delayed the adoption of the triple-expansion engine. That boiler was found in the now familiar and good old type called "Scotch," though there are rival claimants to the honor of being the first to adapt the ordinary boiler to high pressures. It may be both costly and cumbersome, but it still holds its own, and the water-tube type has yet a long way to go before it can win favor in the cargo boats of the merchant service. For this is a service in which delicate handling cannot be ensured, and in which practical confidence must be rested on use and wont. Whether to Randolph & Elder of Glasgow, or to Alexander Taylor of Newcastle-on-Tyne (as some claim) be allowed the credit of initiating the removal of the obstacle to the adoption of the triple-expansion engine, it was really the introduction of mild steel by the Siemens-Martin process that started marine engineering on a new era. Prior to 1881 it would have been almost impossible to find a boilermaker in England who would undertake to build a boiler for a pressure of 150 lbs. The first high-pressure "Scotch" boiler was really built in Scotland by Douglas & Grant of Kirkcaldy for a vessel called the Claremont of 800 tons, which the owners (a Newcastle firm) had decided to fit with triple-expansion engines. The hull was built on the Tyne by T. & W. Smith and the cylinders were 14¼, 20¼ and 40 in. respectively by 33 in. She was essentially a cargo boat—such as we now call a "tramp"—and she marked a new departure in cargo boat machinery. But close on her heels, so close as to be almost simultaneous, was the Aberdeen, also a cargo boat, with cylinders of 30, 45 and 70 by 33 in. stroke. The new material for boilers was quickly appreciated and the adoption of it has been amply justified by the results.

Once the triple-expansion engine was a proved success, it was rapidly adopted, not only for new cargo vessels, but also for old vessels when they came to be refitted. But it required, in the early days, a considerable amount of courage to do what the firm of George Thompson & Co. of the Aberdeen line of clippers to China and Australia did, when giving up sailing vessels for steamers they began by ordering right off a 3,000-ton steamer with triple-expansion engines of 2,000 I.H.P. Some owners were stricken dumb with amazement at the bodness of this move, but it did more than anything else to bring triple engines into vogue, because the firm had a reputation for sagacity, foresight and uniform success. In refitting old vessels to the new system different firms followed different methods. Some superposed the third cylinder on the top of the forward, some on the top of the after, engine; some utilized the mid-eccentric pit for the third cylinder, working the valve gear for the three from two sets of eccentrics only; some attached a third engine complete at the forward end of the bed-plate. The Palmer Ship Building Co., Jarrow-on-Tyne, and some others, fitted an interchangeable crank shaft with the crank pit of the center engine. The three-crank engine with cranks at right angles was the almost natural result of the triple-compound, and it soon became universally adopted; although of late there has been a tendency, wherever space justifies, to return to the double-eccentric link motion. The five-crank engine is, perhaps, the latest development in multiple expansion.

Now see what has been the result of those developments: In 1872 the average coal consumption in cargo steamers per indicated horse power was 2.11 lbs.; in 1881 it was 1.828 lbs.; at present it is 1.5 lbs. Again, in 1881 the average working pressure was only 77.4 lbs.; but in 1900, 80 per cent. of the engines were over 100 lbs., 65 per cent were over 150 lbs., and a considerable proportion were up to 200 lbs. In this connection we give the following table prepared by Mr. James McKechnie of Barrow-in-Furness for the Institution of Mechanical Engineers:

AVERAGE RESULTS OF MARINE ENGINES, 1872, 1881, 1891, 1901.

Boiler, engines and coal.	1872.	Average results 1881.	1891.	1901.
Boiler pressure, lbs. per sq. in.....	52.4	77.4	158.5	197
Heating surface per sq. ft. of grate, sq. ft..	——	30.4	31	38-43*
Heating surface per I.H.P., sq. ft.....	4.41	3.917	3.275	30
Coal per sq. ft. of grate, lbs.....	——	13.8	15	18-28*
Revolutions per minute.....	55.67	59.76	63.75	87
Piston speed, feet per minute.....	376	467	529	654
Coal per I.H.P per hour, lbs.....	2.11	1.83	1.52	1.48
Average consumption on prolonged sea voyage, lbs.....	——	2.	1.75	1.55

*Natural and forced draft, respectively.

Nor are these the only changes in the mechanical equipment of the cargo boat. Twenty years ago steam steering gear, steam capstans and forced draft were rare; now they are universal, with the addition of reversing engines, pumping engines, evaporators, feed heaters, dynamos and what not. A marine engineer withdrawn from service twenty years ago would, if dropped suddenly into the engine room of a modern first-class cargo boat, be hopelessly lost in the multitude and complexity of the new arrangements—yet all so beautifully simple, too. Add to all this that there are now between 300 and 400 vessels on the high seas fitted with refrigerating machinery, and we gain some idea of the advance of applied science in the ocean cargo carrier. We gain also some perception of the tremendous increase in the duties and responsibilities of the marine engineer. Opinions may differ as to the economic value of some of the developments—as, for instance, the five-crank engine itself—but there are none whatever as to the economic value of steel as the structural material for boilers, and of arrangements for the super-heating of steam.

It has been pointed out, however, and may be again recalled, that coal consumption is not the sole measure of economy in ship management. It may even be a subordinate measure in coasting voyages in a country where coal is cheap. In such cases triple-expansion engines working at 160 lbs. may be much less economical than compound engines at a third less pressure. It is on the long voyage, and with the larger class of vessel, that the triple engine is the more economical. Then for the very largest class of modern cargo-carriers the twin screw, or six crank, is found to be preferable to the five-crank. The five-crank engine was, I believe, first applied to a boat called the Inchmona, built and engined at West Hartlepool, and it is said that her coal consumption on a year's work averaged 1.16 lbs. per indicated horse power per hour. This, however, was under very special arrangements to secure a low coal consumption. The average might be taken at more like 1.5 lbs. per indicated horse power. Some engineers, however, do not believe in this manner of gauging the economy of an engine, holding that the measure of coal per horse power is altogether misleading.

I would here refer to the paper read by Mr. James McKechnie recently to the Institution of Mechanical Engineers. Reviewing the marine engineering of the past ten years he thus summarized the results over a wider field than has been sought in this article: Steam pressures, he says, have been increased in the merchant marine from 158 lbs. to 197 lbs. per square inch, the maximum attained being 267 lbs. per square inch, and 300 lbs. in the naval service. The piston speed of mercantile machinery has gone up from 529 to 654 ft. per minute, the maximum in merchant practice being about 900 ft. and in naval practice 960 ft. for large engines, and 1,300 ft. in torpedo-boat destroyers. Boilers also yield a greater power for a given surface, and thus the average power per ton of machinery has gone up from an average of 6 to about 7 I.H.P. per ton of machinery. The net result in respect of speed is that while ten years ago the highest sustained ocean speed was 20.7 knots, it is now 23.38 knots; the highest speed for large warships was 22 knots and is now 23 knots on a trial of double the duration of those of ten years ago; the maximum speed attained by any craft was 25 knots, as compared with 36.581 knots now; while the number of ships of over 20 knots was eight in 1891 and is fifty-eight now. But probably, says Mr. McKechnie, the result of most importance, because affecting every type of ship from the "tramp" to the "greyhound," is the reduction in the coal consumption. "Ten years ago the rate for ocean voyages was 1.75 lbs. per horse power per hour; today in the most modern ships it is about 1.5 lbs. Ten years ago one ton of cargo was carried 100 miles for 10 lbs. of fuel, whereas now, with the great increase in the size of ships and other mechanical improvements, the same work is done for about 4 lbs. of coal, a result which means a very great saving when applied to the immense fleet of over-sea carriers throughout the world." Our survey, however, has been with regard to cargo boats within the last quarter century.

Among the other improvements in cargo boat equipment, beyond the points already referred to, may be mentioned the use of non-conducting material for the covering of pipes and cylinders, the use of fresh water in the boilers, the economization of water, the abolition of the exhaust tank

by the use of the auxiliary condenser, the improvement in furnaces and fire-boxes, and so forth. With the introduction of mechanical draft the supply of air to the furnaces is more under control and the combustion is more perfect. Altogether it is computed that steamers are now able to carry 10 per cent. more cargo with fewer engine-room hands in proportion than twenty years ago.

With regard to the structural design of cargo boats, Prof. Biles had a good deal to say recently to the Institution of Naval Architects. Experience, he said, had shown that increase of size had been accompanied by reduction in the cost of carrying one ton a nautical mile, the working expenses, including coal, wages and upkeep, being less per ton in the large than in the small steamer. It is therefore, an interesting question to consider what would be the effect of further increase of size upon those working expenses. Size might be increased by adding to length, or breadth, or depth, and it is important to consider the effect of each of such increases in respect of stability, strength, and consequent weight of structure and resistance, and indicated horse power. As regards stability, it is necessary in carrying a full cargo of the same density to increase draught approximately in the same ratio as the increase of depth. If this were not done, a cargo of less density must be carried, or there would be empty spaces in the ship. If the less dense cargoes paid increased freight per ton in proportion to their reduced density the commercial result might be at least as good. It is probable that in progressive increase of size there would soon be reached a point where this condition would not be fulfilled, and it would be necessary to find increased weight-carrying in proportion to capacity. This could only be done by increasing the draught. If existing ships have the most profitable ratio of capacity to weight-carrying, it is evident that with increase of depth and breadth must be associated a proportional increase of draught. If they have not, then the most profitable ratio could be obtained by increasing beam and depth until they had. Further increase must then be accompanied by increase of draught. It seems reasonable, however, to assume that experience has taught ship owners what is the most profitable ratio, and that they have long since adopted it; and that in consequence the further increase of beam and depth is dependent on the possibility of obtaining sufficient draught of water in the ports and docks to which they trade. The following is Prof. Biles' estimate of the comparative costs for carrying a ton of cargo 5,000 nautical miles at 12 knots:

WITH CONSTANT DRAUGHT 27 FT. 6 IN.

Length of ship (ft.)	500	550	600	650	700
Cost in shillings per ton of cargo	8.6	9.0	9.6	10.4	11.2

Thus the cost of carrying a ton of cargo increases with the increase of dimensions if the draught is constant. The question arises: If draught be increased proportionately to the other dimensions, is the large ship more profitable than the small? Applying the same system of estimating Prof. Biles reaches the following results:

Length of ship (ft.)	500	550	600	650	700
Draught (ft)	27.5	30.25	33.0	35.75	38.5
Cost in shillings per ton of cargo	8.6	8.0	7.6	7.2	7.0

While breadth and depth are practically the same for both classes embraced in the two tables, the increased draught adds greatly to displacement cargo capacity, etc. The figures, added Mr. Biles, show that if draught were increased proportionately to increase of dimensions the cargo could be carried at a steadily decreasing cost as size increased. The 700-ft. ship would carry 12 tons for the same cost as the 500-ft. ship carried 10 tons. If draught remained constant, the 700-ft. ship would carry 7.7 tons for the same cost that the 500-ft. carried 10 tons. The figures given were based upon weight carried. Assuming that the total capacity of the ship is the measure of earning power, then the respective total working expenses in the two cases have to be related in their respective capacities rather than to their tonnage capacities. The comparisons are as follows, the cost given being per million cubic feet:

Length (ft.)	500	550	600	650	700
Cost per million cu. ft. with constant draught	£5,912	£5,430	£5,000	£4,773	£4,521
Cost per million cu. ft. with increased draught	£5,912	£5,660	£5,380	£5,072	£4,936

From these figures it is seen that the cost of carrying a million cubic feet of cargo decreases with increase of size, provided that its density is not sufficient to load the ship below the practicable limits of draught of the harbor or the ship. Increase of size of the type ship is thus profitable if in a trade where dead-weight cargoes of 70 ft. per ton are carried draught were increased proportionately with the other dimensions. Increase of size is unprofitable in such trades unless accompanied by increase of draught of water. Increase of size without increase of draught is profitable in trades where cargo is of a density gradually reducing with increase of size.

Regarding machinery generally an interesting point has just emerged. Some months ago, there was read at the Institution of Naval Architects meeting in Glasgow, a paper by Mr. John McAlpine on engine vibration. It is now stated that the conclusion at which he arrived, after long research and patient experiment, has been approved by Admiral Melville of the United States navy, as the best solution yet offered of the problem of engine balancing. Admiral Melville's commendation appears to be so pronounced as to indicate the testing of the system on a thorough scale in the United States navy. This pronouncement, it is said, was indorsed by Naval Constructor D. W. Taylor, who remarked that the McAlpine arrangement was a simple and elegant solution. Mr. McAlpine's system is to place two cylinders in line athwart the ship, so that both can be operated on the same crank. For a four-cylinder engine there would thus be but two cranks. One cylinder is connected through its piston and working parts to one end of a lever, the other end of which has a connection to the crosshead of the other engine. This arrangement somewhat resembles that adopted for working the air pumps from the crosshead of ordinary engines. The horizontal and vertical forces arising from the crank, and a determined proportion of the connecting rod, are exactly balanced by revolving counterbalance weights. The rest of the connecting rod, together with the other reciprocating parts over the crank, are equal to those in line with the cylinder alongside, but not above the crank, the stroke of both cylinders being equal. The horizontal forces from the two ends of the lever are equal. It is naturally gratifying to Scotchmen to find an idea first evolved in Glasgow so promptly appreciated in America.

AROUND THE GREAT LAKES.

Capt. Albert Poppe, old-time vessel master and at one time harbor master of Milwaukee, died at his home in that city a few days ago.

John Ginzell of Wyandotte, Mich., has secured a contract to build a wharf 1,000 ft. long and 32 ft. deep on the Detroit river for the Michigan Rock Salt Co.

The C. C. Wormer Machinery Co. of Detroit has just leased a five-story annex to its present building. The company carries a complete assortment of engines, boilers, steam pumps, feed water heaters and outfits of all sorts.

Bids for rebuilding ore dock No. 4 at Two Harbors show that the Barnett & Record Co., Minneapolis, are the lowest bidders. It is announced that the Duluth & Iron Range railway will award the contract to this concern.

A reorganization of the American Rolling Mills Co. of Muskegon, Mich., has been effected and the capital stock increased from $300,000 to $1,000,000. The Muskegon plant will be improved by the addition of another steel furnace which will double the output of the steel department.

The schooner Frank C. Leighton was sold at United States marshal's sale at Chicago a few days ago, Attorney Ray G. MacDonald representing the libelants. She was bid in by W. S. Kelsey at the sum of $3,500. Capt. Benjamin Calhoun will continue to be master and she will be employed in the salt trade next season.

Capt. John Smith and Lawrence Dempsey of Manistee, Mich., have purchased the steamer Frances E. Spinner and the price paid is said to be $45,000. The Spinner has been at Burger & Burger's ship yard at Manitowoc since last season, having been towed there from St. Mary's river after her collision with the steamer H. D. Coffinberry.

Belleville water tube boilers in the Northern Steamship Co.'s large passenger steamers North West and North Land will be replaced during the winter by Scotch boilers. The new boilers will be built at the Lake Erie Boiler Works, Buffalo, and the necessary changes in hulls of the vessels will be made by the American Ship Building Co. It is said that the change will cost about $175,000.

Capt. P. Peterson of Green Bay, Wis., has sold the steamer Thos. Christie to Capt. P. Larson and others of Chicago. The Christie will be converted into a lumber carrier to trade between Menominee and Chicago. The steel steamer Katahdin, which was built by F. W. Wheeler at Bay City, but which has been on the Atlantic coast for three years past, has been sold by H. W. McCormick and others of Bay City to the Export Lumber Co. of New York. She will carry lumber from Georgetown to New York.

Directors of the Detroit & Buffalo Steamboat Co., the organization that is to operate between Detroit and Buffalo the two large side-wheel steamers that are building at Detroit, met in Detroit a few days ago. W. C. McMillan was elected treasurer and general manager, B. C. Wilder secretary and assistant treasurer, and A. C. Angell a director to fill the place on the board left vacant by the death of David Carter. The election of Mr. McMillan as general manager carries with it the appointment of D. C. McIntyre as general freight agent, and A. A. Schantz as general passenger agent.

It would seem that the war department is disposed to place big river works on the lakes in charge of younger officers than have had to do with these works in the past. No objection is expected from the vessel interests, as their experience with young officers has always been satisfactory. The young men are active and spend money on improvements as fast as they get it from congress. For several years the Cleveland district was in charge of an officer with the rank of colonel, but the last change gave this place to Major Kingman, and now it is announced that Major Bixby, at present in Cincinnati, is to succeed Col. G. J. Lydecker, in charge of the most important improvements on the lakes, those of the St. Mary's and Detroit rivers.

Articles of association of the Breitung Hematite Mining Co., Ltd., have been filed in Marquette. It is a Marquette corporation, capitalized at $1,000,000, divided into 40,000 shares of $25 each. The stock has been subscribed for as follows: Edward N. Breitung, $495,000; Charlotte G. Breitung, $5,000; Mary Kaufman, $450,000; Nathan M. Kaufman, $50,000. One-half of the capital is in cash, to be paid for in installments or otherwise, as the board of managers may direct, and for the remaining half there has been contributed the following described property: A leasehold interest in all that part of the southwest quarter of the southeast quarter, and of the southeast quarter of the southwest quarter, of section 6, lying south of Partridge brook in township 47, north of range 26 west, in the city of Negaunee. The two tracts which are owned jointly by the Breitung and Kaufman interests are valued at $500,000 and are leased for a term of twenty years. This is the land which was recently held in dispute between the Cleveland-Cliffs Iron Co. and the Breitung-Kaufman interests, the litigation involving the validity of the ninety-nine year lease under which the company claimed to mine ore on the tracts as the successor of the old Pioneer Iron Co. This lease was held by the court to be invalid. The lands are reported to contain a valuable deposit of ore.

Some interesting details as to the height of waves recorded on the east coast of Scotland have been communicated to the Institution of Civil Engineers by Mr. William Shield, the engineer at the Peterhead harbor works, where the records were taken. With a gentle breeze there came for three days a heavy ground swell as a precursor of the storm. Then up came the storm from the southeast, veering to east-southeast, the velocity of the wind rising from 57 to 89 miles per hour within thirty-six hours. The waves, carefully measured by instruments, were found to be irregular, both as to height and length, but wave after wave passed, having its crest quite unbroken, fully 22 ft. 6 in. above the still-water level. Assuming the troughs to be as far below the still-water level as their crest was above it, the height of the waves would thus be 45 ft. The period between the waves varied from 13 to 17 seconds, and their lengths were probably between 500 ft. and 700 ft.

ARMOR AND THE GUN.

CAPT. E. B. BABBITT, OF THE UNITED STATES ARMY, DECLARES THAT THE STRUGGLE IS DRAWING TO A CLOSE AND THAT THE PROJECTILE IS IN THE LEAD.

Among the papers read at the recent meeting of the Society of Naval Architects and Marine Engineers in New York was one by Capt. E. B. Babbitt of the ordnance department of the United States army. Secretary Washington L. Capps, who read the paper in the absence of Capt. Babbitt, said that it was so important that the permission of the secretary of war had to be secured before it could be delivered. The paper was as follows:

CAPT. E. B. BABBITT.

"The struggle between the armor and the projectile is drawing to a close. The limit of flotation has practically settled the thickness of armor to be carried, and the manufacturers now bend their energies, with remarkable success it is true, to improving the armor. With all this, however, the projectile is in the lead, and has now brought to its assistance the valuable aid of high explosives. The ordnance department of the army has been experimenting for many years to secure a high explosive for a shell filler, and with varying success. In the reports of the ordnance board conducting these tests in 1883, 1884 and 1885, they usually concluded with 'burst at the muzzle' or 'destroyed the gun.' Naturally, then, the problem, as it presented itself to them, was to secure an explosive that could safely be fired from a high-powered gun. As we approach it now, that is really but a corollary to the condition that it will not explode on impact on armor, as the shock in the latter case is so much greater.

"When the board of ordnance and fortification was organized, the tests with high explosives took a wider range, due partly to the larger fund at its disposal and partly to the increased activity of the manufacturers for a time. The sub-committee of this board considered at length this subject and reported that the following points were to be investigated:

"First—Which is the best explosive for use in shells?

"Second—Is an explosion of the first order, or detonation, assured with the different methods of loading proposed by the inventors to prevent premature explosion?

"Third—Will the explosive stand the friction due to rifled motion when loaded as proposed?

"Fourth—Will the explosive stand the shock of firing when loaded as proposed by the different inventors?

"Fifth—Will the igniting mechanism stand the shock of firing and the rifled motion without premature action?

"Sixth—Will the igniting mechanism act as desired?

"Seventh—Will the shell, without the igniting mechanism, explode on impact with water, with earth, with stone, with wood, or light iron, and with iron armor?

"Considering these it appears: That the first is the summation of those that follow. The second, in its investigation, led to extensive subterra experiments which, while instructive, really led the investigators from the true scope, namely, to get an explosive that could be used in a shell. The third condition was quite a bugaboo, and comes to us even today. I have my doubts as to its importance. In a moment of mental aberration, I devised a fuse depending for its action upon a plunger within remaining at rest while the envelope took up the rotation of the projectile. I had no doubt about this feature, but, wishing to investigate another, made such a plunger, supported, by the way, by an axial shaft, thus reducing the frictional moment, and fired it from a field gun into a sand butt. When recovered and opened—behold! the plunger had not moved in its housing. Thus ended a threatened revolution in the fuses of the world. As my brother officer, Capt. Crozier, would say, 'ideas are cheap; worth about 25 cents a bushel'—when one is developed into something tangible it is priceless. Of the remaining conditions, those regarding the fuse or firing mechanism are important, since in the later development a successful explosive waited on a satisfactory fuse.

"At the time of this report, 1891, there were before the board explosive gelatine, gun-cotton, emmensite, schwalin mixture, and americanite. Of these gun-cotton alone is now considered as a shell filler, and then only wet and with a matrix. Between 1892 and 1896, there were tested in addition: Terrorite (N. G. and nitro ethyl and nitromethyl); rackorock, a spengle safety mixture; ammonite, 90 per cent. ammonium nitrate and 10 per cent. mono-nitro-naphthalene; jovite, 87 NH_4NO_3 and nitro-phenols and nitro-naphthalene. None met with success. Between 1896 and 1898 the ordnance department experimented largely with gun-cotton, in various forms and degrees of moisture, and met with considerable success, thanks to a detonating fuse devised by Capt. W. S. Pierce, ordnance department. In 1898 thorite began its brilliant but short career.

"The sensitiveness of most of the high explosives brought forth during this period many novel ideas for firing them with safety, the most notable being the famous pneumatic dynamite guns, three of which were mounted on the Vesuvius, and were used at Santiago with so little effect. As late as August 23, 1899, a charge of 129½ lbs. explosive gelatine was fired from a 12-in. service rifle using an Isham diaphragm shell. The explosion of this mass against a 12-in. plate failed, on impact, to rupture the plate, but moved it bodily. More damage was done to a similar plate with a service armor piercing shot, uncharged. With the reorganization of the ordnance board in 1899 was introduced the present system of investigation, which, in its workings, has brought about conclusive results, and has, it is thought, given a most satisfactory explosive and fuse; in other words, a most powerful weapon for attack, superior to any possessed abroad of which we have any knowledge. I can do no better than quote the following reply of the ordnance board to a letter from the chief of ordnance asking about the status of the question of high explosives for shell:

"'From the nature of the subject it is evident, and experience has amply demonstrated the fact, that the selection of a high explosive shell which shall be thoroughly efficient and yet safe beyond any reasonable doubt to store, handle and fire under all conditions of service, presents a most difficult problem which offers chances of failure at every step and can be considered solved only when these requirements are satisfactorily established by exhaustive tests. The destructiveness of the explosive makes it a constant menace to the men and material using it, and a perfected projectile involves not only the explosive but the fuse and the method of constructing the shell also.'

"A satisfactory high explosive for shell should fulfill the following requirements:

"First—Should be reasonably safe in manufacture and free from very injurious effects upon the operatives.

"Second—To warrant further test, must show a relatively safe degree of insensitiveness in the impact testing apparatus used by the department.

"Third—Must withstand the maximum shock of discharge under repeated firings in the shells for which it is intended.

"Fourth—Must withstand the shock of impact when fired in unfused shells as follows: In field shell, maximum velocity against 3 in. of oak timber backed by sand; in siege shell, against seasoned concrete thicker than the shell will penetrate, with remaining velocity for full charge at 500 yards range; in armor-piercing shell, against a 7-in. tempered steel test plate in a 12-in. A. P. shell with a velocity just sufficient to penetrate.

"Fifth—Must be uniformly and completely detonated with the service detonating fuse.

"Sixth—Should possess the greatest strength compatible with other necessary requirements.

"Seventh—Must not decompose when hermetically sealed and subjected to a temperature of 120° F. for one week.

"Eighth—Should be preferably non-hygroscopic, and must not have its facility for detonation affected by moisture that can be absorbed under ordinary atmospheric exposure necessary in handling.

Ninth—Must not attack ordinary metals used in projectiles and fuses to an extent that cannot be prevented by simple means.

"Tenth—Must not deteriorate or undergo chemical change in storage.

"Loading—This must not be attended with unusual danger, and should not require exceptional skill or tedious methods. It is very desirable that the explosive be capable of compact loading either by melting or compressing into solid blocks.

"Supply—Should be possible to procure the explosive quickly and in quantity in this country at a reasonable cost.

"To carry out investigations covering all these conditions involved constructing a comprehensive scheme of test and the expenditure of much money. The object being to get the explosive through the armor, the final test would naturally be a practical trial under service conditions. These costing from $3,000 to $5,000 per round could be very few and means had to be devised for an early elimination of those doomed to failure. We therefore determined: First, the relative force (by calculation) for actual density of loading in shell; second, the specific gravity; third, density of loading; fourth, charge contained in 100 cubic inches; fifth, approximate cost of charge; sixth, ease of supply; seventh, method of loading; eighth, safety in manufacturing; ninth, stability in heat test; tenth, non-hygroscopic; twelfth, non-active on metals.

"If the above were satisfactory the explosive was tested in an impact testing machine devised by Capt. Dunn, a member of the board. In this is provided a shallow cup in an anvil capable of holding a few grains (by weight) of the explosive in such a manner as to prevent lateral expansion. By noting the height of fall of a known weight, the relative insensitiveness is determined. It is of interest to know that, in every case, subsequent armor tests have borne out the conclusions reached with this little machine. Having once determined a limiting drop, below which an explosive would fail in a gun, it is easy to reject, without firing, all those below that limit, and indeed select only those approaching a higher drop limit that would indicate insensitiveness to impact. A projectile acquires its velocity in passing over the entire length of the bore of a gun, but, if stopped by an armor plate, is arrested in a very small fraction of the first distance. It is, therefore, evident that the shock of impact is the severer test, and it is here that the tests become most interesting. We have no means of determining the law of retardation in a plate, so for comparison are forced to assume that it is constant over the path. Under this assumption, considering the length of column of the explosive in each service shell, and the armor against which it is tested, it can be shown that the shock to the explosive in a 6-pdr. shell against a 3-in. nickel steel plate is greater than in any of the service tests. For this reason, and on account of the relative inexpensiveness, the 6-pdr. rapid-fire gun was selected for the preliminary tests against armor. Standard plates 1 in., 1½ in., 2 in., and 3 in. are used and firings made at each in order, till either the explosive bursts on impact, or successfully resists the highest plate. The results of the first series of tests following this method are as follows:

SUMMARY OF TESTS OF 6-PDR. STEEL SHELL CHARGED WITH HIGH EXPLOSIVES AND FIRED (UNFUSED) AGAINST STEEL PLATES OF VARYING THICKNESS.

"Plates—Braced against 6-in. oak backing (110 ft. from gun) with intervening clear space of 20 ft. to stand butt in rear; so placed in order to observe action of shell after penetrating target, and to collect fired shell or their fragments from the butt. The following plates were used: Carnegie tempered (nickel steel) plates, 36x36 in., 1, 1.5 and 2 in. thick; fragments of mild steel plate, 3 in. thick; Carnegie tempered (nickel steel) plate 38x40 in., 3 in. thick.

"Projectiles—Six-pounder A. P. shell, steel, for which the acceptance test requires penetration of a 3-in. mild steel plate, without fracture, base fuse dismantled and brass fuse stock cut off to be flush with the rear end of shell cavity when screwed home; hollow in stock filled with plaster of paris. The projectiles were filled, flush with the inner end of fuse hole through base, with the following explosives: First, black musket powder, filled loosely into shell cavity, average charge of 4 ounces; second, Rendrock company's No. 400 explosive, heated to pasty condition, and tamped with wood stick in shell cavity, average charge 9.08 ounces; third, picric acid, melted and poured into shell cavity, average charge 6.41 ounces; fourth, gun-cotton pellets containing 15 per cent. moisture, loaded with matrix formed of 60 parts paraffine, 25 parts resin, and 15 parts beeswax, average charge 2.025 ounces; fifth, 10 per cent. maximite, melted and poured into shell cavity, average charge 5.85 ounces; sixth, 25 per cent. maximite, melted and poured into shell cavity, average charge 6.075

ounces; seventh, explosive D. in powder, tamped as well as possible with wood stick through fuse hole, average charge 4.375 ounces.

Shell charge.	No. of rounds.	Plate (thickness), inches.	Action of shell.
Sand	2	1.5 T.	Penetrated target. Recovered whole.
Black powder	1	1.0 T.	Penetrated target and burst 4 ft. in rear.
	1	1.5 T.	Penetrated target and burst close behind.
	1	2.0 T.	Penetrated target and burst 3 ft. in rear.
No. 400 explosive	2	1.0 T.	Penetrated target and burst 30 in. in rear.
	1	1.5 T.	Penetrated target and burst close in rear.
Picric acid	2	1.0 T.	Penetrated target. Both had plug blown out between target and butt. Low order of explosion.
	2	1.5 T.	Both penetrated plate. One deflected to sea and lost; one exploded violently in backing.
	1	2.0 T.	Exploded in plate. Point passed through target and base blown to rear over gun shelter.
Gun-cotton	1	1.5 T.	Penetrated target and recovered whole. Charge slightly set forward at rear.
	1	2.0 T.	Penetrated target and exploded in butt.
Maximite, 10 per cent.	1	2.0 T.	Penetrated target and entered butt apparently whole. Not recovered.
	2	3.0 M.	One penetrated target and recovered whole. Charge not disturbed. One stuck in plate with base imbedded 1.5 in. Charge slightly set forward at rear.
Maximite, 10 per cent.	1	1.5 T.	Penetrated target and recovered whole. Charge not disturbed.
	1	2.0 T.	Same, except charge slightly set forward at rear.
	2	3.0 M.	One penetrated target and recovered whole. Charge slightly disturbed at rear. One stuck in plate, head projecting about one-half through, not exploded.
Explosive D	2	2.0 T.	Penetrated target and recovered whole. Charge slightly disturbed at rear.
	2	3.0 M.	One same as preceding. One stuck in plate and broken in two across middle section; explosive not ignited.

(T., tempered; M., mild steel plate.)

"It is seen that the black powder, No. 400 explosive, and picric acid, all failed to penetrate the 1-in. tempered steel plate without explosion; some superiority for picric acid is only shown in that the explosion was less violent than with the other two. The 1.5-in. plate produced a violent explosion of picric acid as well as of black powder and No. 400 explosive. Gun-cotton passed the 1.5-in. plate test but failed with the 2-in. plate. The two grades of maximite and explosive D passed the 2 in. plate test and also the test with 3-in. mild steel to which they were subjected. A 3-in. tempered steel plate was then mounted to give an extreme test for these explosives. The powder charge was increased to give a striking velocity of 1,920 f/s. with which four rounds were fired, and also two rounds fired with a charge giving a striking velocity of 1,970 f/s., namely:

VELOCITY 1,920 f/s.

Shell charge.	No. of rounds.	Plate (thickness), inches.	Action of shell.
Maximite, 10 per cent.	1	3 T.	Struck squarely, and point passed 4½ in. beyond front face of plate. Shell broken and fragments rebounded, leaving clean hole. Explosive ignited, as shown by cloud of smoke.
Maximite, 25 per cent.	1	3 T.	Point penetrated about 4.25 in. Shell rebounded 110 ft., badly set up. No explosion.
Explosive D	2	3 T.	One with same penetration as preceding, and one striking somewhat obliquely, penetrated about 3 in.; both broken. Explosive formed cloud of powder; not ignited.

VELOCITY 1,970 f/s.

Maximite, 25 per cent.	1	3 T.	Badly upset and broken on plate. Cup-shaped hole about 1.5 in. deep. Explosive ignited, as shown by cloud of smoke.
Explosive D	1	3 T.	Same as preceding, except hole 1.7 in. deep. Explosive formed cloud of powder; not ignited.

"These tests led to the selection of two explosives, namely maximite and explosive D, as worthy of final test. Owing to the impossibility of controlling the explosives in an ordinary explosive chamber, fragmentation tests are made by burying the larger shell, fully charged and fused, about 10 ft. in sand and firing the fuse electrically. Fragments are then dug out, weighed and counted. Careful search is made for any unexploded material. The following extract from these fragmentation tests gives an idea of the results obtained:

"First—Twelve-inch A. P. shell, maximite, buried 10 ft. in sand; Frankford arsenal A. P. detonating fuse; weight of empty shell and fuse, 960 lbs., 4 oz.; weight of explosive charge, 50 lbs., 12 oz.; total, 1,011 lbs.; weight of metal recovered, 827 lbs., 7 oz.; number of fragments counted, 3,690; small pieces, estimated, 2,718.

"Second—Twelve-inch A. P. shell charged with explosive D, buried 12 ft. in sand; Frankford arsenal detonating A. P. fuse; weight of empty shell and fuse, 951 lbs., 4 oz.; weight of explosive charge, 57 lbs., 12 oz.; total, 1,009 lbs.; weight of metal recovered, 815 lbs.; number of fragments, 850.

"The first result quoted above is much above the average and has not been duplicated. Indeed there is a limit to the size of useful fragments. A large number of fair-sized fragments driven with high velocity throughout the interior of a vessel would cause more damage than a much larger number of small fragments. Such a statement is always subject to modifications. If, for example, a shell should burst in a crowded part of the vessel, as was the case in the turret of the Japanese flagship at the battle of the Yalu, the more violent explosion would be more disastrous.

"Both explosives having met all requirements up to this point there remained the final tests against armor. Twelve-inch armor-piercing shot having sufficient velocity for penetration, are required to pass through a 12-in. face-hardened plate before the lot represented by the projectile is accepted. This was, therefore, adopted as the final test for the explosives, namely, that they must withstand the shock of impact of such a projectile on such a plate. It was led up to by firing first a 5-in. shell through a 3-in. tempered plate. Next, a 12-in. A. P. shell through a 7-in. tempered plate, and finally a 12-in. A. P. shot (capped) through a 12-in. harveyized plate. All these were unfused, and, in every case, the projectiles were recovered and later, fragmented to increase our data on this subject. It should be stated that all armor plates are supported by heavy backings of oak strongly braced, and in rear of this is a large mound of sand in which the projectile finally comes to rest. At last the final test was reached.

"Imagine the tension as, from a safe distance, we stood with eyes to our glasses anxiously watching the distant field. The target, a 5¾-in. tempered steel plate, well backed with oak, defiantly faces the long slender 12-in. rifle. The red flag waves from the firing bomb proof. It is answered. The flag falls, a bank of smoke from the gun, a flash of light at the plate, a dense, black, forboding mass of smoke interspersed with flying timbers and bits of plate, two mighty roars in quick succession, a sigh of relief and satisfaction from the observers, and, for the first time, a 12-in. armor piercing shell, loaded and fused, has passed through heavy armor. While, later, heavier plates were used and the results therefore more satisfactory, the first success ever stands out most vividly in the minds of the experimenters. The official record of this test reads as follows:

"No. 7. Twelve-inch A. P. shell charged with explosive D, 58½ lbs.; weight of charged shell complete, 1,021 lbs.; fired March 27, 1901, with Frankford arsenal detonating A. P. fuse complete against 5¾-in. tempered steel plate; striking velocity, 1,475 f/s.; shell penetrated plate and detonated immediately in rear; plate broken and carried forward with numerous fragments of shell.

"Tests against 7-in. steel plates and 12-in. face-hardened plates followed with great success. Finally, encouraged by the successful results, a 12-in. A. P. shell (the test of which is a 7-in. steel plate) was fired against a 12-in. face-hardened plate. The record reads:

"No. 11. Twelve-inch A. P. shell charged with explosive D, 58.6 lbs.; weight of charged shell complete, 1,010 lbs; fired May 17, 1901, with Frankford arsenal detonating A. P. fuse complete against a piece of 12-in. face-hardened steel plate; pressure in gun, 29,900 lbs. per square inch; velocity, about 1,875 f/s.; shell detonated in plate and completely demolished plate and backing, all being carried forward and swept away; fragments of plate thrown to a distance of 200 to 300 ft., and gave evidence that the plate was penetrated by the shell.

"In summing up the final tests we find:

	Explosive D.	Maximite.
Shell fragmented by detonating fuse	8	11
Shell fired from gun unfused	13	13
Shell fired from gun fused	13	10
	—	—
	34	34
Results entirely satisfactory with respect to explosive	34	33
Premature action of explosive, cases afterward remedied	—	1
Fuses acted feebly—remedied	3	1
Fuses failed	1	—

"Before closing it is necessary to mention a most important factor in this success, namely, the fuse. But, of this, little can be said. It is the secret of all our triumphs, and as such is being carefully guarded. It, like the explosive, passed through various stages. It was tested separately for its power to detonate the shell charges; its power to resist shock of discharge and impact; and, finally, under service conditions. It had its failures in the early stages, but, thanks to the skill and energy of Capt. Beverly W. Dunn of the ordnance department, won out in the end. One of the most serious questions connected with an armor-piercing fuse is its delay action. Introducing, as it does, the time element, it is evident that an interval suited to light armor would not be satisfactory for heavy when the time of penetration is greater. As by far the greater part of a ship's protection is relatively light armor, a delay sufficient to cause detonation a few feet after penetration seems best. This gives us a burst when a shot is still in the 12-in. plate, but has penetrated. I think I am safe in saying that the results just enumerated are unique, and so far surpass those previously obtained as not to admit of comparison with them."

SHIP YARD NOTES.

The 10,000-ton tramp steamship Shawmut was launched from the yard of the Maryland Steel Co., Sparrow's Point, Md., last week for the Boston Steamship Co. The steamer measures 505 ft. over all, 488 ft. between perpendiculars, 58 ft. beam and 40 ft. depth. She will be schooner rigged with two masts and one smokestack, and will have six water-tight bulkheads with a double bottom extending her entire length. There will be four single-ended Scotch boilers, 15 ft. in diameter and 12 ft. long.

The Pusey & Jones Co., Wilmington, Del., has signed a contract with Capt. C. H. Holmes of New York to build a steel hull passenger and freight steamer to ply between New York and Greenwich. The vessel will be driven by a single screw and will measure 130 ft. in length, 26 ft. beam and 9 ft. in depth. The engine will have cylinders 14 and 26 in. diameter with stroke of 22 in. The boiler will be of the Scotch type, 11 in. diameter and 10 ft. 6 in. in length.

The Baltimore, Chesapeake & Atlantic railway has given a contract for a fine sidewheel steamer to the Harlan & Hollingsworth Co., Wilmington, Del. Following are the dimensions: Length, 190 ft.; beam, 53 ft.; depth, 10 ft. There will be forty staterooms and accommodations for at least 200 passengers. The approximate cost is $140,000.

George M. Pychon of Chicago has placed an order with the Townsend & Downey Ship Building & Repair Co., Shooter's Island, N. Y., for a 60 ft. racing sloop. The designs are by Gardiner & Cox, who will superintend the construction.

W. Starling Burgess of Boston is designing a six-masted schooner for A. C. Crandall and others. She will be built by John M. Brooks of East Boston and will be 350 ft. over all, 305 ft. keel, 50 ft. beam and 30 ft. depth of hold.

Framework is being erected preparatory to framing the battleship Georgia at the Bath Iron Works. Riveting is progressing rapidly on the Bigelow yacht.

Keel and the sternpost of the dredger which is building at the yard of G. A. Gilchrist, Rockland, Me., are in position.

Arthur Sewall & Co., Bath, Me., will stretch the keel of the steel barge for the Standard Oil Co. this week.

The Hon. Peter White.

A Biographical Sketch of the Lake Superior Iron Region.

BY RALPH D. WILLIAMS.

PART III.

Ely's steam railroad was finished to the mines in September, 1857. One of Peter White's recollections is rowing out in a row boat some time prior to this to inspect the locomotive Sebastopol brought up from Paterson, N. J,. as it stood upon the deck of the brig Columbia in Iron bay. This was the first locomotive to reach the peninsula. It was soon followed by a second, which was brought up on the schooner E. C. Roberts and was named C. Donkersley in honor of the first superintendent of the railway. The carrying capacity of the railway with this motive power was, when all conditions were favorable, 1,200 tons per day. The conditions obtaining at the time can probably be more graphically conveyed by the publication of a fac simile of an editorial published in the Lake Superior Journal on Aug. 15, 1857, which was two or three weeks before the railroad went into operation. It is amusing today to think that 1,200 tons was ever regarded as an avalanche, but it is a fact that no one identified with the iron industries comprehended the future demand for iron and the enormous consumption destined for it. Indeed the evolution of the world was necessary to beget such comprehension. Industrially the world was pretty young even as late as 1857.

It was in 1857 that the land office was transferred from Sault Ste. Marie to Marquette and Peter White was made land agent. A little later he added to his duties that of collector of customs of the port of Marquette, the city being made in that year a port of entry in place of Sault Ste. Marie. It might be supposed that these various offices would keep the young man busy, but Peter White perceiving that there were certain minor cases arising constantly to be adjudicated in the little town, undertook the study of law in order that he might be the better prepared for any emergency that might arise. Paint you no picture of a man sitting at the feet of some learned authority and drinking deep of legal lore. There was neither lawyer nor judge in Marquette then. Rather paint a picture of a young man studiously reading the standard works of law by the light of a candle and conning them quite thoroughly until he had the great branch of equity at his finger tips. A college of law will teach equity last, but Peter took it first. The pine knot and the tallow dip have taken their place in American fiction because so many characters, famous in American history, have employed them to lay the enduring foundations of their education. Peter White is one of them, for the United States supreme court later admitted him to practice before it upon the information which he had wrung from the law books in the days when he was pioneering. He later formed the law firm of White and Maynard, but after ten years practice surrendered the entire business to his partner.

On Sept. 29, 1857, the Rev. Henry Safford united in marriage Ellen S. Hewitt and Peter White.

The Cleveland company was the first in the world to adopt the pocket system of loading ore in the construction of the dock. The idea came from the coal fields of Pennsylvania where coal was handled by means of a chute. The Cleveland company built a trestlework upon its dock, and by 1858 had constructed nine or ten pockets with chute attachments. The pockets held only a few tons and were small in comparison with the immense structures of today, but nevertheless they were the forerunner of the present wonderful system of loading iron ore, whereby 6,000 to 8,000 tons may be loaded upon a vessel within a few hours. Peter White had his hand in it. He secured the contract to furnish all the pine to be used in the construction of the dock, but Gordon beat him down on figures so that there was absolutely no profit in it. As he was leaving with his contract Gordon called him back and said:

"We'll pay $5 extra for all the yellow pine you furnish," mentioning the measurement.

"Very well, sir," said Peter.

He did not tell Gordon that he could furnish nothing but yellow pine, as there was not a stick of white pine in the immediate vicinity of Marquette. So the contract was a good thing for him after all.

At this time there came to live in the Harlow family, as a cook, an Indian woman named Angelique, whose story as related is the most tragic in the annals of Lake Superior history. The good God was kind to this woman when He gave her great resistance to suffering and an exhaustless reservoir of physical endurance. She had need of them. She was forest born and inured to privation from her birth. She was free limbed, full grown and was possessed of enormous strength. She seemed indeed to be fashioned to demonstrate to what reaches of suffering the human frame could go and still withstand the shock, for it is not conceivable that any other human being could have possible endured it. Her husband, a Frenchman named Charlie Mott, perished miserably. This woman was actually left on Isle Royale with her husband from July 1, 1845, until the following spring with only half a barrel of flour, six pounds of butter and a few beans as provisions. Her thoughts, her sensations, her struggles, her ruses to cheat hunger, the horror which she felt lest she might awake some day from a delirium to find herself eating her dead husband provide a tale of somber tragedy which is unrelieved by a single ray of light. She lived by snaring rabbits with deadfalls made out of the hair of her head. She was rescued in the spring by the crew of the Algonquin, of which Capt. John McKay, the father of Capt. George P. McKay, was master.

It is strange that this tale so pitiless, so convulsive in the completeness of its cruelty has never found its way into fiction. The mind of the novelist has depicted no suffering to equal it.*

The year 1857 was one of panic. When iron's down its down. When things are generally flat iron is the flattest of them all—and things were pretty generally flat in 1857. Money was not to be had at all. It appar-

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Iron--Mining--Receipts--Shipments.

The experiment with the light cars on the T rail, of which we spoke last week, works to perfection; indeed we are informed that they run better, even, than on the strap rail, and more safely. The result of the first weeks trial shows a perceptible increase in the amount of ore brought down, and the probabilities are that it will be still more increased next week. There are now twelve sail vessels and one propeller loading and waiting to load with ore, and there is not a pound on the dock except that which comes down from day to day. At this rate it will take about four weeks to load those that are now here, to say nothing of more which may arrive. This is a point at which we did not expect to arrive this season, and hence our repeated request to send along vessels. But it is useless to deny the fact that our present facilities for bringing down ore are insufficient, and our present circumstances with so many vessels waiting, are anything but desirable. But it is an old but true saying, that "it is always darkest just before the dawn," so now, our companies are having their greatest difficulty in supplying their vessels, just before the time when the ore can be brought down like an avalanche, at the rate of 1200 tons per d'em, with the present motive power at command. Were it not for this we might apprehend trouble in the future, from the present delays of vessels, but they all understand this, and will undoubtedly be ready to go on with the business again next season, notwithstanding the vexatious delays now. The amount of ore taken out of the mines can only be limited by the number of men employed so that there is no cause of apprehension on that score. If a sufficient amount of ore was now on the docks, the amount shipped would be at least one-fourth more than it will be as it is, yet we trust that next season will more than make the present loss good.

The receipts on the deck, for the week ending Aug.,14th, are per

Cleveland I. M. Co.	**654**	**gross**	**tons**
Sharon Iron Co.	**650**	**"**	**"**
Total	**1,304**	**"**	**"**

Shipments during the same time.

Cleveland I. M. Co. per			
Schr. Constello	**254**	**gross**	**tons**
Prop. Mineral Rock	**101 1-2**	**"**	**"**
Total	**350 1-2**	**"**	**"**
Sharon Iron Co. per			
Prop. Mineral Rock	**102**	**"**	**"**
Schr. Exchange	**429 1-2**	**"**	**"**
Total	**531 1-2**	**"**	**"**
Total for the week	**882**	**"**	**"**

A portion of this weeks receipts is now on board of vessels that are not fully freighted.

Angelique later gave the following graphic account of her winter on Isle Royale, which is submitted for the tremendous force of the narrative:

"When I and my husband Charlie Mott were first married we lived at La Pointe. Mr. Douglas, Mr. Barnard and some other 'big bugs' from Detroit had come up there in the schooner Algonquin, looking for copper. From La Pointe Charlie and I went over with them, on their invitation, to Isle Royale. After landing with the rest I wandered a long way on the beach until I saw something shining in the water. It was a piece of mass copper. When I told the Algonquin people of it they were very glad and determined at once to locate it. They said if Charlie and I would occupy it for them Charlie should have $25 a month and I $5 a month to cook for him. Having agreed to the bargain we returned to the Sault to lay in a good supply of provisions. There I first met Mendelhall, the man who brought us into all this trouble. He said there was no need of carrying provisions so far up the lake and at so heavy an expense as he had plenty of provisions at La Pointe. When we got to La Pointe we found that this was not so. All we could get was a half barrel of flour (which we had to borrow from the mission), six pounds of butter that smelt badly and was white like lard and a few beans. I didn't want to go to the island until we had something more to live on, and I told Charlie so, but Mendelhall over-pursuaded him. He solemnly promised him two things; First, that he would send a batteau with provisions in a few weeks; and then, at the end of three months, he would be sure to come himself and take us away. So, very much against my will, we went to Isle Royale on the first of July. Having a bark canoe and a net, for a while we lived on fish, but one day about the end of summer a storm came and we lost our canoe; and soon our net was broken and good for nothing also. Oh, how we watched and watched and watched but no batteau ever came to supply us with food; no vessel ever came to take us away; neither Mendelhall's nor any other. When at last we found that we had been deserted and that we would have to spend the whole winter on the island, and that there would be no getting away until spring, I tell you such a thought was hard to bear indeed. Our flour and butter and beans were gone. We couldn't catch any more fish. Nothing else seemed left to us but sickness, starvation and

ently did not exist. The iron companies were hard put to it to get working capital and keep their men in good humor. It was at this time that the genius of W. J. Gordon came into play. He devised a medium of exchange which later came to be known as iron money. This form of exchange was in the shape of neatly-engraved and printed drafts for small denominations upon the treasurer of the home office of the iron companies, issued by the mining agents in payment for labor and material. The banks accepted these drafts as readily as they accepted government currency. Surely the United States government had no greater reserve for its paper than had these mining drafts. The reserve consisted of mountains of precious ore. When the banks had accumulated a hundred or a thousand dollars worth of the drafts they were sorted out according to the companies which issued them and presented to the home office, when a ninety-days draft, interest added, would be given for them. This iron money remained in circulation for a great many years. It helped to relieve a stringency which otherwise would have stalled the iron industry.

In 1857 quite a settlement had grown up about the Jackson mine and it was decided to give it a name. A council was held with the Ojibwa Indians and the name Negaunee was chosen, which signifies in their language the first or pioneer. It was quite appropriate, as the first mine was opened there and the first furnace, the Pioneer, established there. The following year the growing town about the Cleveland mine demanded a name. The citizens appealed to Samuel P. Ely who in turn appealed to Peter White.

"The ridge of land upon which the Cleveland mine is located," quoth Peter, "is the highest ground between Lake Superior and Lake Michigan. It is the divide where one may see the waters of the Carp flowing into Lake Superior and the waters of the Escanaba flowing into Lake Michigan. Ojibwa for an altitude of this character is Ishpeming."

"Let's call it Ishpeming," exclaimed Ely, "it is a beautiful word."

"It also means Heaven in an abstract sense," added Peter.

"That's better than ever," replied Ely.

And so the town was christened Ishpeming.

The immediate effect of the breaking out of the war in 1861 was an added depression in the iron business, and it forced a number of the little furnaces to the wall. Stephen R. Gay, who had been instrumental in introducing blast-furnace methods in the peninsula and under whose guidance the Pioneer furnace was built, had started the Bancroft furnace in 1860. Peter White had loaned him what little money he had to spare, but Gay was unable to weather the storm, bred by the rebellion, and Peter White had to step in as secretary and treasurer to protect his own interests. He was busily engaged, too, in organizing a company to go to the front and he was elected its captain. At this stage Marquette protested. It felt that it needed him more than the war required his services and he was persuaded not to go. Peter's duties were growing upon him, and he prepared to relinquish the office of postmaster which he had held for nearly a dozen years. He was, however, before surrendering the office, to have an experience which remains with him quite vividly today. Wherever there is wood chopping to be done there is a Frenchman to be found. The Canadian-French went to Marquette in great numbers, for all the furnaces were fed with charcoal. Many of them could neither read nor write, but nevertheless they took sweet pleasure in letters from home. They had numerous legends of Peter White. They knew that he had disappeared in years gone by whenever the mail was uncommonly late and had come back with letters for them. Some of the poor creatures thought that he went as far as Montreal for the mail. They could not understand it otherwise. He was a mysterious being to the French and their families, and was always associated in their minds with dogs, snow shoes, sleds and Indians. In April and May, even when government delivery had been regularly established, the mails were frequently late owing to the deep snows. One night a steamer arrived, the first of the season, bringing the accumulations of a month of mail. Peter had taken it to his office and was distributing it as expeditiously as possible by candle light, as he knew that at 6 o'clock in the morning a large crowd would have congregated for their letters. The postoffice was merely a small room in the rear of the store, just large enough for a table, chair and the mail bags. Peter had dumped the mail upon the table and was standing distributing the letters into their respective boxes when he heard a slight noise in the forward part of the store. Michel Belloin, a tall and powerful Frenchman, was approaching. It needed but one look at Michel to observe that he had been drinking heavily.

"You got any lette for Micho, Monsieur Pete," asked he, staggering up to the rail.

"Come in the morning," answered Peter, "I am just assorting the mail now."

"I guess I will come into your little poss offis and sit on dat little chair and see you put dose lette in that box," answered Michel, and suiting the action to the word he undertook to enter the narrow door.

"There isn't room for you," exclaimed Peter, "it is against the law. You cannot come in."

"Oh ho! What you spose I care for de law or you neder? I will come in anyhow. You can't stop me."

As he lifted one foot to step over a mail bag at the door, Peter gave him a quick push which caused him to fall backward to the floor and very much enraged him. Arising he paced backward and forward across the store floor, grating his teeth and clenching his fists, calling Peter all manner of names and uttering all sorts of imprecation and epithets in French. Finding that Peter was paying no attention to him he stopped at the door of the little postoffice and shouted:

"You want to preten you don stand French. Mon Dieu, you don talk good Hinglish. You just a half a breed, half French and half Hinjin. I know what you want. You want me to strike you, then you bring me on the justis offis tomarrow morning and make me pay five dolar. Aha! You can't fool Frenchman lika dat. You come on to de street if you want me to strike you. If I strike you I won't leave two greas spot on you. If I strike you you'll tink it is a French horse kick you. You see dat spit down dere? The sun he come he dry it up. Dat's just like you. If I strike you you can't fine yourself anymore. You wouldn't know where you gone to. I come to your poss offis to 'quire for some lette, and I hax you, just so polite I can, if you got any lette for Micho, and

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death itself. All we could do was to eat bark and roots and bitter berries that only seemed to make the hunger worse. Oh, sir, hunger is an awful thing. It eats you up so inside, and you feel so all gone, as if you must go crazy. If you could only see the holes I made around the cabin in digging for something to eat you would think it must have been some wild beast. Oh God, what I suffered there that winter from that terrible hunger, grace help me. I only wonder how I ever lived it through.

"Five days before Christmas (for you may be sure we kept account of every day) everything was gone. There was not so much as a single bean. The snow had come down thick and heavy. It was bitter, bitter cold and everything was frozen as hard as a stone. We hadn't any snow shoes. We couldn't dig any roots; we drew our belts tighter and tighter; but it was no use; you can't cheat hunger; you can't fill up that inward craving that gnaws within you like a wolf.

"Charlie suffered from it even worse than I did. As he grew weaker and weaker he lost all heart and courage. Then fever set in; it grew higher and higher until at last he went clear out of his head. One day he sprang up and seized his butcher knife and began to sharpen it on a whetstone. 'He was tired of being hungry,' he said, 'he would kill a sheep—something to eat he must have.' And then he glared at me as if he thought nobody could read his purpose but himself. I saw that I was the sheep he intended to kill and eat. All day, and all night long I watched him and kept my eyes on him, not daring to sleep, and expecting him to spring upon me at any moment; but at last I managed to wrest the knife from him and that danger was over. After the fever fits were gone and he came to himself, he was as kind as ever; and I never thought of telling him what a dreadful thing he had tried to do. I tried hard not to have him see me cry as I sat behind him, but sometimes I could not help it, as I thought of our hard lot, and saw him sink away and dry up until there was nothing left of him but skin and bones. At last he died so easily that I couldn't tell just when the breath did leave his body.

"This was another big trouble. Now that Charlie was dead what could I do with him? I washed him and laid him out, but I had no coffin for him. How could I bury him when all around it was either rock or ground frozen as hard as a rock? And I could not bear to throw him out into the snow. For three days I remained with him in the hut and it seemed almost like company to me, but I was afraid that if I continued to keep up the fire he would spoil. The only thing I could do was to leave him in the hut where I could sometimes see him, and go off and build a lodge for myself and take my fire with me. Having sprained my arm in nursing and lifting Charlie this was very hard work, but I did it at last.

"Oh that fire, you don't know what company it was. It seemed alive just like a person with you, as if it could almost talk, and many a time, but for its bright and cheerful blaze that put some spirits in me, I think I would have just died. One time I made too big a fire and almost burned myself out, but I had plenty of snow handy and so saved what I had built with so much labor and took better care for the future.

"Then came another big trouble—ugh—what a trouble it was—the worst trouble of all. You ask me if I wasn't afraid when thus left alone on that island. Not of the things you speak of. Sometimes it would be so light in the north, and even away up overhead like a second sunset, that the night seemed turned into day; but I was used to the dancing spirits and was not afraid of them. I was not afraid of the Mackee Monedo or Bad Spirit for I had been brought up better at the mission than to believe all the stories that the Indians told about him. I believed that there was a Christ and that He would carry me through if I prayed to Him. But the thing that most of all I was afraid of, and that I had to pray the hardest against was this: Sometimes I was so hungry, so very hungry, and the hunger raged so in my veins that I was tempted, O, how terribly was I tempted to take Charlie and make soup of him. I knew it was wrong; I felt it was wrong; I didn't want to do it, but some day the fever might come on me as it did on him, and when I came to my senses I might find myself in the very act of eating him up. Thank God, whatever else I suffered I was spared that; but I tell you of all the other things that was the thing of which I was the most afraid, and against which I prayed the most and fought the hardest.

"When the dreadful thought came over me, or I wished to die, and die quick, rather than suffer any longer, and I could do nothing else, then I would pray; and it always seemed to me after praying hard something would turn up, or I would think of something that I had not thought of before and have new strength given me to fight it out still longer. One time in particular I remember, not long after Charlie's death, and when things were at their very worst. For more than a week I had had nothing to eat but bark, and how I prayed that night that the good God would give me something to eat, lest the ever increasing temptation would come over me at last. The next morning when I opened the door I noticed for the first time some rabbit tracks. It almost took away my breath and made my blood run through my veins like fire. In a moment I had torn a lock of hair out of my head and was plaiting strands to make a snare for them. As I set it I prayed that I might catch a fat one and catch him quick. That very day I caught one, and so raging hungry was I that I tore off his skin and ate him up raw. It was nearly a week before I caught another and so it was often for weeks together. The thing seemed so very strange to me that though I had torn half the hair out of my head to make snares never once during the whole winter did I catch two rabbits at one time.

"Oh how heavily did the time hang upon me. It seemed as if the old moon would never wear out and the new one never come. At first I tried to sleep all that I could, but after a while I got into such a state of mind and body that I could scarcely get any sleep night or day. When I sat still for an hour or two my limbs were so stiff and dried up that it was almost impossible for me to move them at all; so at last, like a bear in a cage, I found myself walking all the time. It was easier to walk than to do anything else. When I could do nothing else to relieve my hunger I would take a pinch of salt. Early in March I found a canoe that had been cast ashore and which I mended and made fit for use. Part of the sail I cut up and made the strips into a net. Soon the little birds began to come and then I knew that spring was coming in good earnest. God indeed had heard my prayer and I felt that I was saved. Once more I could see my mother.

"One morning in May I had good luck fishing and caught no less than four mullets at one time. Just as I was cooking them for breakfast I heard a gun, and I fell back almost fainting. Then I heard another gun and I started to run down to the landing, but my knees gave way and I sank to the ground. Another gun—and I was off to the boat in time to meet the crew when they came ashore. The very first man that landed was Mendelhall, and he put up his hand to shake hands with me, which I did. 'Where is Charlie,' said he. I told him he was asleep. He might go up to the hut and see for himself. Then they all ran off together. When Mendelhall went into the hut he saw that Charlie was dead. The men took off Charlie's clothes and shoes and saw plain enough that I had not killed him, but that he had died of starvation. When I came up Mendelhall began to cry and to try to explain things. He said that 'he had sent off a batteau with provisions and didn't see why they didn't get to us.' But the boys told me it was all a lie. I was too glad to get back to my mother to do anything. I thought his own conscience ought to punish him more than I could do."

Angelique died at Sault Ste. Marie in 1874. It is related of her that once she made a wager with a Frenchman that she could carry a barrel of pork to the top of an adjoining hill and back. She won it with ease, and upon her return volunteered to carry the barrel up again with the Frenchman on top of it.

you say 'Get out.' Ain't you shame yourself—don't you sorry you treat me that way? I'm going to tell you someting make you sorry you say so cross to me. I tink I will make your face come red. Some Frenchmen been come here good many year ago; he ben tole me dat you use to carry de mail on your back and a pack on your back, a hax in your hand, snow shoe on your feet and sometime tree poor little dog on a train draw de mail tru de woods, and your tree littel dog was so poor you could see right tru him. (And here the excited speaker held up his hands with fingers widely distended to represent the visible ribs of the poor dog). Coz you was so damn poor. You did'n have money to buy provision for dat dog. Now you got to be the pos offis master and you tink you are the biggest big bug on dis town—and when I come to your poss offis jus so polite I can, and hax you you got any letter for Micho, you say 'Get out dar' like one dam dog. I like to know if dat's the way to treat a gentleman. I guess you did'n tot dat I know I could tell you all dat. You tink now you biggest big bug on this whole town."

In 1863 Peter White incorporated his bank into a national bank, calling it the First National Bank of Marquette, and he became its cashier. Meanwhile he was selling off and on a little iron to vessel men. When no other freights offered, vessel men were in the habit of buying a little iron in the hope that they could sell it for a few dollars extra at the lower lake ports and thus earn a fair freight rate for the trip. If iron could be bought at $15 a ton at Marquette and sold for $20 at a lower lake port there was fair remuneration in it for the vessel owner. Peter had come into possession of considerable iron through his connection with the Bancroft furnace and he had disposed of it gradually to vessels as they called at Marquette. There are some men who are gifted with prophetic vision. Possibly it is only reasoning power developed to the highest sense. Grant was slowly but surely hemming the Confederate armies in and the country was assuming a healthier and more normal tone. All at once it dawned upon Peter White that the nation would need iron and that the foundries and mills were going to be caught without an adequate supply of their raw material —pig iron—on hand when the demand came. He packed his grip and started on the track of vessels to which he had been selling iron for months previously. He found a quantity of his own iron on several of the docks, particularly at Detroit, and he bought it back at an advance of $6 per ton over the price at which he had sold it—surely a good profit for the vessel man. He bought all that he could find upon this trip—and then he went to Cleveland. Almost before he got there the demand came, greatly stimulated by heavy orders from the government for guns and railway equipment.

THE HON. PETER WHITE.

From a recent photograph.

"Want any pig iron?" asked Peter White walking into the office of the Otis Foundry Co. in Cleveland.

"I should say we do," replied Otis, "and I'll pay $42 a ton for it if I can get any."

Peter sold 1,000 tons at that figure before the day was done. He had paid $24 a ton for it. In two weeks he had cleared $35,000. He kept mighty still about it, though. He had the shrewdness to know that it is good policy to keep still when you're making money and to keep still when you're losing money. Iron went to $75 a ton before the year was out, the highest figure it has ever reached in the history of the country. It was these transactions in iron which laid the foundation of Peter White's fortune.

The iron companies had by this time got fairly upon their feet and were returning handsome dividends upon the capital invested. It may seem surprising at this day, now that we know so much of what they actually possessed, that the financial part of the enterprise should have been in doubt. But it was—and seriously so. Time was the asset which all of these iron companies needed. The Cleveland and Jackson companies declared their first dividend in 1862.

One Sunday afternoon in 1864 Peter White was down at the dock watching the unloading of a steamer which had just arrived. A distinguished-looking gentleman approached him, who turned out to be none other than Mr. Breckenridge, the vice-president of the Confederacy, and who had just been placed upon parole upon his honor. He was en route for Canadian territory with a party of Southern gentlemen upon a hunting expedition, and telling Peter White that he had just been informed that he was the banker of the town, asked him if he would let him have gold for his paper currency.

Peter White instantly took the vice-president of the Confederacy to his bank building, and, unlocking the door with his private key, entered. The teller who had a room overhead was seated in the bank reading. Peter introduced his distinguished companion, and stating his mission requested the teller to open the door to the vault. To the intense astonishment of the vice-president of the Confederacy, and no less to that of Peter White himself, the teller refused to do anything of the kind.

"I do not believe," said he, "that business of any character whatever should be transacted on Sunday. This gentleman can doubtless wait until tomorrow morning."

Mr. Breckenridge explained that his steamer was to leave that very afternoon, and that, unfortunately, he could not wait. He added that he would not have sought the favor had it been possible for him to wait until the morrow. It became quite clear, however, that the teller's religious scruples were too deeply rooted to be disturbed by the plight of the vice-president of the Confederacy. The more they argued the more resolute he grew.

"Very well," said Peter, "write the number of the combination on a piece of paper and I will open the safe. You can just scribble the figures in an absent minded way."

"That would be equivalent to opening the safe," replied the teller. "It would be merely whipping the devil around the stump. I cannot transact business on Sunday, either directly or indirectly. I decline to give you the combination of the safe."

Most men would have exploded, and Peter White is not to be blamed if his color heightened a bit. But he said nothing.

"I believe I can get the money elsewhere," he said, turning to Mr. Breckenridge and leading the way out of the bank.

He secured the gold from a friend and Breckenridge went on his way rejoicing. The next morning the teller entered Peter White's private office and tendered his resignation.

"I don't suppose," said he, "that you will have any further use for my services."

Peter White tore up the letter of resignation.

"I am not going to discharge you for sticking up to your principles," said he, "I couldn't discharge any man for defending his conviction. I would not, however, have acted as you did. I don't believe you displayed good judgment."

A little later when the teller wanted to go into business for himself Peter White gave him $10,000 without security.

Marquette in its center slopes gently to the lake and both east and west the descent is abrupt. The western part is known as the Ridge, a most appropriate name since it is both rugged and high. It commands a view of the entire city, the beautiful Presque Isle and a vast expanse of the waters of Lake Superior, sometimes turbulent and sometimes as placid as a pond. It was upon this ridge, directly overlooking the lake, that Peter White secured thirteen acres of land and in 1867 built the house which is his home to this day. It was for many years the most splendid residence in Marquette.

In 1868 the town of Marquette was burned to the ground, but Peter White's house on the Ridge was not a part of the catastrophe. The only thing of a business kind saved was the Cleveland dock. Among the ruins

was the plant of the Mining Journal, owned by Peter White. He sold the good will and subscription list to A. P. Swineford for $100. There was little else to sell at that moment but even at that it was a great bargain. Swineford resurrected the remains and made a good paper out of it.

CHAPTER V.

Peter White had now grown to be an influential citizen and was clearly and unmistakably the first man in Marquette. As banker, real estate agent and capitalist he was invariably consulted when any new enterprise was started in the town. If it was worthy he encouraged it by a personal investment, and by this policy he both made and lost money.

"I have bought," said he in later years, "considerable stock in various companies, but I have never sold a share in any of them. Some have been good and some have been very bad, but on the whole I have come out a little ahead. At any rate, by this policy I am sure that no person has ever lost any money through me."

When the town of Marquette was incorporated and was entitled to have a mayor the people turned instinctively to Peter White. He consented to run. He is a Democrat in principle and is so yet, but he severed his affiliation with the party when it surrendered its assets to the Populists. Now envy is one of human nature's frailties, and when Peter White consented to run for mayor a certain number got together and nominated a rival candidate. Peter White made no campaign and neither did his supporters; but the opposition worked night and day. They toured the highways and byways incessantly, and when the votes were counted it was found that the opposition had elected their candidate by a majority of sixty-one. Great was the indignation of Marquette. They felt that an outrage was committed. The successful candidate was fearfully mortified over the result. He declared that he went into the contest as a joke and that he would not have gone into it at all if he had had the remotest idea that he was going to be elected. He implored Peter White to take the office and when Peter White declined he actually wept. Four years later when Peter White was out of town he was unanimously elected mayor of Marquette. This is probably the only instance on record where a man obtained a mayoralty without a single dissenting vote. But he sent in his declination by wire. And so he never has been mayor of the town.

A lasting friendship was formed between Peter White and Samuel P. Ely, and when Mr. Ely was elected mayor of Marquette, Peter White commemorated his administration by building a library and dedicating it to the city. In addition he presented to it 10,000 volumes. He has since added to these gifts, until now it is one of the most complete libraries in the northwest.

In 1875 a number of Detroit capitalists began to project a railway from St. Ignace to Marquette under the title of the Detroit, Mackinaw & Marquette Railway, and Peter White was again sent to the legislature to see about the grant to aid in the development of this enterprise. He went to the senate. His influence was felt instantly and irresistibly. It had been nearly twenty years since he had made his trip to Lansing on snow shoes, but the memory of it had not been forgotten. This time he went by railway. Through his efforts the projected railway was an assured undertaking, and the people of Marquette went out to meet him upon his return. A delegation went up the line to meet his train, but these he successfully evaded. Not so at the railway station in Marquette, however. A vast number had congregated and the enthusiasm was unbounded.

FROM A FLASHLIGHT PHOTOGRAPH TAKEN AT MIDNIGHT IN PETER WHITE'S CAMP BY HIS SON-IN-LAW GEORGE SHIRAS. (Copyrighted.)

Amid laughter, shouting, fireworks and general rejoicing they unhitched the horses from his sleigh and drew him to his home.

During the years with which he was connected with the Cleveland company as its real estate manager he sold hundreds of thousands of dollars worth of property, the principal transaction being the sale of the Cleveland dock to the Marquette & Western Railway in 1882—a branch of the Detroit, Mackinaw & Marquette, which was constructed to tap the iron mines and was the only rival the old Iron Mountain Railway ever had. The rivalry didn't last long, however, as the Marquette & Western quickly absorbed the Iron Mountain. They're all a part of the Duluth, South Shore & Atlantic now.

In 1885 a memorial chapel was erected by Mr. White adjoining St. Paul's cathedral, in memory of his son Morgan. It is a beautiful edifice in brown stone. It has never been consecrated, as it was the express wish that it should be available at all times for the use of the guilds for entertainments both musical and dramatic. Mr. White is an Episcopalian by affiliation, but his creed is universal. He has assisted in the establishment of every church in Marquette—Methodist, Presbyterian, Catholic, Lutheran and others. He was instrumental, too, in founding St. Luke's hospital.

Peter White's monument is Presque Isle. This is a tract of land, densely wooded, 328 acres in extent, and is, as its name signifies, "almost an island." It lies a little to the west of Marquette harbor. It has a rock-bound shore which lends itself to rugged and picturesque effects. Some of the formations, particularly Arch rock, are most unique.

"What a park it would make," soliloquized Peter White.

But, alas, the government had reserved Presque Isle for light-house

purposes and government is inclined to be set in its ways. It presents the most frowning aspect to any suggestion of change from its customary method of doing things. It has a special and particular horror of establishing a precedent. The light-house board, having established a station on Presque isle, that island was forever dedicated, as far as the light-house board was concerned, to that purpose. The light-house board would regard any suggestion that it be used as a park as little short of anarchy. Having been once a light-house station it could never be anything else—things go on the same year in and year out in Washington. Peter White could see the rock-ribbed, green-topped island from his study.

"Moffatt," said he, "why can't we have that as a park?"

Moffatt—he was the peninsula's congressman—was speechless at the suggestion. It was an involuntary reflection of the attitude of the light-house board on his part. He knew that that was the way the light-house board would act when the subject was broached to it—stiffen and freeze at once.

"It can't be done," said Moffatt.

Peter White packed his grip and went to Washington and saw the members of the committee on public lands of the house. They were all very glad to see him—the six Democrats and seven Republicans—but they were very sorry indeed that nothing could be done for him.

"Peter White's Monument is Presque Isle."

"Can't do it," said the six Democrats and seven Republicans in chorus.

"Will you report the bill favorably if the senate passes it?" asked Peter White.

As there was no hope in the minds of the committee that the senate would pass it, they unanimously agreed to this proposition. Peter White went into Senator Tom Palmer's room in the senate wing of the capitol. Palmer knew him of old and was genuinely glad to see him. The story of Peter White's life was an old one to Palmer, but the incidents in it were ever new. He told what he wanted as simply as he could.

"I am going to get a couple of senators in here," said Palmer," and you repeat to them just what you have told me."

Palmer went out and accosted two or three senators. Peter related his unselfish mission to them. The story wasn't much, but the man back of the story loomed up a gigantic figure before them. It wasn't what he said about the beauties of the island that moved them; it was the knowledge that here was an original character that had hewed a city out of a wilderness, that had cheerfully submitted to untold privation and hardship in order to give the iron frontier the benefit of a civilized life; that had time and again plunged into a desolate waste in the dead of winter to snatch a few comforts for his fellow beings. It wasn't what he said that had carried them away; it was the force of forty years of incessant toil and manly living. Senators straggled in by twos and fours and met the northern stranger. In the face of such service as he had rendered to the country, Presque Isle seemed to them a pretty small recompense. Time-honored practices and fear of precedents were flung aside, and the bill giving Presque Isle to the city of Marquette for park purposes was passed at once. The breath of the committee on public lands of the house was nearly taken away, but the members were true to their promise. They recommended the bill and it passed the house promptly. Peter White got the president to sign it and he returned to Marquette with a draft of it in his pocket.

The bill contained the natural provision that the park was to be accepted by the council of Marquette and maintained by the city. The usual obstructionist was in the council. He made a fiery speech in which he declared that the park would benefit only the rich and that the citizens of Marquette would be forever saddled with the expense of keeping the driveways in condition for those who rode in carriages. The workingman would get no pleasure from it whatever. He pictured the oppressive nature of the burden so zealously that the council actually decided to reject the gift. At the next meeting Peter White appeared before them. He was sorely vexed that the city was to be deprived of so magnificent a pleasure ground through the short-sighted policy of a council.

"I understand, gentlemen," said he, "that your only objection to accepting this park is the cost of its maintenance."

"Yes, sir," said the spokesman.

"I will not argue with you tonight how mistaken you are," said Peter White," in declining a gift which will eventually be of the greatest boon to the workingman and which will provide an eternal pleasure ground for your children and your children's children. I will, however, meet the only objection which you have raised. If you will accept the park I will personally pay the cost of its improvement and maintenance during the next five years."

The park was accepted instantly. Usually when men devote great sums of money to improvements of this character an ulterior motive is likely to obtain. They may hold contiguous property which will be greatly improved thereby. But Peter White held no property contiguous to Presque Isle. There is no available property contiguous to Presque Isle. It is all unreclaimed. The first thing that Peter White had to do was to build a roadway a mile or more long across this unreclaimed stretch. Water to a depth of a foot or two had to be filled in and the roadway built upon it. That cost $30,000. The improvement and maintenance of the park cost $35,000 in addition, a generous and unselfish contribution. The effect, however, has been to make the whole city of Marquette a park. Presque Isle is a lovely spot today and has an extensive and well-kept zoo upon it.

As an illustration of how little things may effect the current of one's life, the visit of Judge Matthews to Marquette is given as evidence. The Indians were adepts in making models of birch-bark canoes, but the gradual elimination of the Indian has eliminated also their handiwork. Birch-bark canoes are becoming very scarce but the judge was anxious to obtain one. Seeing a beautiful little model of one in the First National Bank, he asked Peter White where he might get one.

"You may have this one," said Mr. White.

"I do not want that one," answered the judge. "Where will you get another?"

"The Indians may as well make me one," replied Mr. White. "I've got to support them anyhow."

The judge took the model and the incident might have been regarded as closed. But later it became necessary for the judge to appoint a master in chancery for the Pewabic Copper Co. and the parties to the suit were unable to agree upon a proper person to act.

"If you fail to reach any conclusion I have a man in mind," said the judge." I don't know much about him except that he gave me this birch-bark canoe, and I believe that he can be trusted. He is Peter White of Marquette."

The parties agreed to the selection and Peter White was appointed master in chancery for the Pewabic Copper Co.

Mr. White later became a member of the Mackinac Island state park commission and during the last four years has been its president. Under his management this island has been literally transformed. It is probably without exception the most beautiful spot on the chain of lakes and the most liberal policy dominates its management. The little village that was there when Peter White first visited it in 1845 is there yet, quaint, curious and insular; but all else is changed. It is a perfect fairyland now and is the summer resort of the north.

And thus we bring our hero down to the present day, full of years and of honors and palpitating with life and energy.

EPILOGUE.

A review of this man's life would be a review of the history of the peninsula of Michigan. His life compasses all that is modern in the history of that princely territory—the richest in a mineral sense that has ever been discovered. The only part of it which his life does not embrace is the pre-industrial period. What antedates him is largely legend or fragmentary exploration; and even of this history he has gathered as much as he could and fixed it in the imperishable pigment of prose. But it is because he has lived throughout the entire industrial era that his life has historic value. The changes since he first ripped the sod off the iron of the Cleveland mine in 1849 have been vast. That blow altered the face of a continent. Instead of the stubborn and rebellious mule hauling a four-ton car on a little strap railroad there is now plying to this self-same mine some of the most powerful locomotives ever constructed and the freight traffic along the old roadbed is among the heaviest in the world; instead of a 100-ton schooner receiving its cargo up a gang plank there is a 7,000-ton steamer being loaded by means of a trestle dock with its pockets and chutes in a quarter the time in which it took to load the little schooner—and all coming from these self-same deposits; instead of the old strap road at the Portage and Sheldon McKnight and his old gray horse there is a wide and deep canal whose traffic is more than twice as great as that of Suez; instead of the miles of crazy ladders in the mines there is the steam hoist with its safety clutches; instead of the painful loading and unloading

of cars by human labor, there is the steam shovel and the drop bottom; instead of an annual output of 1,447 tons, there is an average yearly output of 20,000,000 tons; instead of freight from $3 to $6.25 per ton from Marquette to Ohio ports, as it was in 1866, there is the present trip-to-trip rate of 80 cents, and a contract rate over a term of years of even less than that figure. But how immeasureably has this never-ending stream of ore changed the mode of the world's life. Its profusion and its cheapness of transit have contributed more than any other one thing to the industrial success of the nation. It has made its presence felt in every form and condition of existence. It has called into being the largest fleet of vessels in the world devoted to a single industry, and it has found employment for millions in its contributary channels. It has made hundreds rich, thousands independent and hundreds of thousands contented and comfortable; and the one person who typifies and personifies this great and giant region is Peter White.

We will take leave of him at his camp—the kingly side of him. The camp is twenty-four miles from Marquette and four miles from the railroad. Do you think that Peter White rides from the railroad to the camp? Not a bit of it. He walks, walks with the quick, impulsive, springy, forward movement of the second Frederick and acts as though he were tireless, as indeed he probably is. The camp is 800 acres in extent and consists of virgin forest with river, swamp and lake and a little clearing in the center. The clearing is at the side of a maple grove and in it stands the camp dwelling, constructed most picturesquely of logs. The clearing is devoted to a garden where all fruits and vegetables that the peninsula will raise are cultivated. The river, called Whitefish river—probably because there are no whitefish in it—flows past the door. The whitefish is a dainty feeder and loves clear and sparkling water. The water of the Whitefish river, like many of the little rivers in the peninsula, is stained by the roots of trees and shrubs through which it passes. But if there are no whitefish in the river there are far greater attractions in the camp. Free, wild and unfenced, as it is, it is the natural haunt of the deer. They are very abundant and in summer are very tame and one may see them eating at a distance; but in fall and winter they are very wary and it is only a wild crash through the bushes that notifies one that he has encroached too closely to their presence. There are wolves, too, far more plenty than is comfortable for the defenseless classes of wild animals, and Peter White and his companions go on an annual expedition of extermination. The camp is filled with the trophies of the chase. His son-in-law, George Shiras, son of Justice Shiras of the United States supreme court, who married the only living child of Peter White, hunts with the camera and has made some wonderful photos of deer at the camp by flashlight at midnight. These photos took the world's prize at the Paris exposition last year. He adjusted a headlight to his canoe, and paddling silently towards shore was enabled, after innumerable attempts, to photograph the deer by flashlight. While the slightest noise will frighten deer the mere presence of light does not seem to concern them. It is probably because instinct has taught them to regard it as some phenomenon of nature. The boom and crash of a great boulder down the side of a hill will scarcely make a deer look up from its grazing, wnile the faintest click of artificial sound will send them flying in terror. It will be noted that in the photograph reproduced herewith the picture was taken before the doe had time to raise its head; the click of the mechanism of the camera in the unrecorded part of a second thereafter sent the frightened creature flying through the woods.

One day this summer Peter White's butler, Charles, in walking from the railroad to the camp with his employer noted a little girl, about eight years old, limping about on a crutch with one leg drawn up and the foot about 2 in. from the ground. He had seen the little girl limping about in that fashion during the preceding summer.

"Isn't it too bad," said he, "that that little girl should have to limp all her life like that. There is probably something the matter with her knee that prevents her straightening her leg."

"Hey," said Peter White.

Charles repeated his observation, together with the fact that he had seen her in that condition during the previous year.

"Go to the house at once and see what's the matter with her," commanded Mr. White." If her folks can't afford to pay for medical treatment I will."

The little one was taken to St. Luke's hospital in Marquette, where it was found that she was suffering from a hip disease which prevented her from straightening her leg and was the result of an injury received over a year ago. The physicians stated that had it been attended to at once it could have been remedied within a week, but that now bones would have to be broken and pulled into place through pressure and that months would be required for the cure. The operation was performed and the little one is now lying strapped in bed with weights, which are hanging over the footboard, attached to her feet. Peter White is paying the bill. It is pleasant to record, though, that the child is surely recovering and will have the full use of two sound limbs.

Peter White as a raconteur is unexcelled. His French-Canadian stories are of particular excellence. Whenever he visits the legislature at Lansing the house goes into committee of the whole and he is invited to address them, to relate his tales of early days and to tell his famous stories. Extensive reading has made him erudite. His knowledge is profound. He is an authority on finance and political economy.

Peter White as he is today.

Though he belongs in the United States senate as a fine type of American citizen, we will leave him at his camp, sitting before a crackling fire of wood and telling stories to a little circle of companions. He had lived an upright life and he views the past with satisfaction and the future without concern.

"The way to riches is through hard work and thrift," said he.

It is not always the pioneer who prospers, but this pioneer wrested a fortune from the frontier and is putting it to honorable use. There are innumerable legends concerning him. Some think that he is French-Canadian and that his name is Pierre le Blanc; some think he is an Indian and that his real name is Shob-wauway; and some believe that he is the reincarnation of Pere Marquette. But he is a simple American gentleman, seventy-one years old, and sturdy as an oak.

ITEMS OF GENERAL INTEREST.

The navy department has announced the formal acceptance of the battleship Wisconsin.

The Automatic Coaling & Weighing Co. of Brooklyn, N. Y., has been incorporated in Delaware with a capital stock of $500,000.

The newspapers lately reported that the Standard Oil Co. intended equipping its tugs with oil fuel burning apparatus, but the Standard in a letter to the Review says that while it is burning oil in one of its tugs it is not making any special tests nor accumulating any data.

The steam yacht Skibo, built for Mrs. Andrew Carnegie, was launched last week at Lewis Nixon's ship yard, Elizabethport, N. J. Mrs. Carnegie christened the boat. The yacht is 82 ft. long, 6 ft. beam and 6 ft. draught. Mr. and Mrs. Carnegie will go to Florida on the yacht's initial trip.

The torpedo boat destroyer Decatur, which was built at the William R. Trigg Co.'s yards, Richmond, Va., had her final trial over the Barren island course in Chesapeake bay on Dec. 12. The vessel made an average speed of 28.137 knots per hour for two hours. The test was satisfactory in every particular.

Mr. F. C. Whitman of Annapolis Royal, N. S., writing to the Review says: "We are developing our iron interests in Nova Scotia and have a body of hematite ore within a few miles of this place. At Torbrook the estimate is 100,000,000 tons of ore. It has been taken up by Mr. George C. Corbett of this place and he is now interesting both American and English capital to develop and manufacture iron."

Messrs. William Peterson, Limited (formerly Peterson, Tate & Co.), steamship owners and brokers, closed their office in Montreal on the 10th inst., and their late manager, Mr. T. R. McCarthy, immediately started business on his own account, at the same address, No. 6 St. Sacrament street, as a steamship and freight broker. Mr. McCarthy will engage in chartering and forwarding and will conduct a general commission agency. He will act as broker for the sale, purchase and construction of steamers and sailing vessels and will also effect insurance in both fire and marine lines.

The Phoenix Iron Works of Portland, Ore., which was incorporated last week by Samuel Morrow, M. G. Wolff and Louis Steinhauser with a capital stock of $20,000, has leased a part of the plant of the Wolff & Zwicker Iron Works, which failed recently. The new concern has chosen officers as follows: President, Samuel Morrow; vice-president, C. H. Fuchs; secretary and treasurer, Louis Steinhauser; superintendent and manager, Fritz Wolff. The Wolff & Zwicker Iron Works, which the company succeeds, failed because it took a number of government contracts for building torpedo boats and destroyers which resulted in a heavy loss.

According to the London Standard's Odessa correspondent a ministerial report just published states that the Russian mercantile marine consisted, on Jan. 1, 1901, of 745 steamers and 2,293 sailing vesels. Last year thirty-eight steamers of 35,193 registered tons, were added to the mercantile fleets of the Baltic and Black seas, while the increase in the Caspian and White seas was but trifling. Of the total steam tonnage, 59 per cent. is owned by share companies, 21.9 per cent. by private individuals. The largest steamship firms are those working on the Black sea. The Russian Steam Navigation & Trading Co. of Odessa possesses a fleet of seventy-two steamers, representing a total of 67,654 registered tons; the Russian East Asiatic Co. has three steamers aggregating 12,618 tons; the Russian Baltic Co., five steamers of 7,896 tons; the Archangel-Murman Co., thirteen steamers of 6,233 tons; the Orient Transport Co., twenty-five steamers of 13,702 tons; and the Kavkaz & Merkuri Co., on the Caspian, twenty steamers representing 11,934 tons. Those are the chief Russian maritime concerns, exclusive of the volunteer fleet of fourteen steamers of 45,209 tons.

MARCONI'S AGREEMENT WITH LLOYDS.

The details of the agreement between the Marconi International Marine Communication Co. and Lloyds are given in the current number of the London Electrician. By the terms of this agreement the Marconi system of wireless telegraphy is placed upon a secure and enduring footing for mercantile marine signaling and intercommunication between ships and coast signal stations. As is well known, up to the advent of the Marconi system, communication between passing ships at sea and between vessels and the Lloyds signal stations have been by flag signals. Against this system, which has been in use for centuries, many objections have been made. Distance was always a drawback, as the range of vision even on a clear day is limited, and in foggy or stormy weather or in the night no signaling except the "pilot flare" and the signal of distress is in vogue. Further than this it has often been necessary for a vessel to go out of her course to signal coast stations, thus losing valuable time, and often running into danger in the effort to get near enough to the station to give and answer messages. Besides this the system of flags is cumbersome, and only a few phrases can be sent back and forth.

Now that the Marconi system has been proven a success, it seems strange that there has not been more haste in taking it up on all merchant vessels. Of course, the question of monopoly will arise, for, according to the agreement, Lloyds will employ no other system of wireless telegraphy than that of the Marconi company for the next 14 years, but as the Morse system and the telephone were monopolies it should be no drawback. They will receive commercial messages at their signal stations from any vessel supplied with the Marconi apparatus, and will also send messages to any such vessel; but they will receive or transmit no wireless telegraph communications whatever where a vessel is equipped with apparatus not supplied by the Marconi company. By this agreement the monopoly is established, for it will be necessary for vessels desiring to communicate with shore in that way to get that particular apparatus. It would be interesting to know what would be done in the case of signals of distress, but it is more than likely that this great possibility of the system will not stand in the way of humanity, and that the stations will promptly report any vessel which may be in difficulties whether or not she has the Marconi apparatus on board.

The agreement further provides that whenever a center for commercial wireless telegraphy with ships would be advisable, the existing Lloyds stations at these points shall be worked on the Marconi system; or, if no station exists within about twenty miles, a new Lloyds station will be built, and, of course, be placed in ordinary telegraphic communication with the British Postoffice lines. Arrangements have been made by which Atlantic liners fitted with Marconi apparatus will be supplied with all the latest important news as soon as they come within about 100 miles of the coast of America or the British islands. The rental system, which has been in force with the Marconi company, will not be used under the agreement, but a tariff system will take its place. Signal stations will be allowed free use of the apparatus for the ordinary receipt of Lloyds signals, and vessels signaling to one another are permitted a certain number of free service messages; but for all commercial messages a charge of sixpence per word, in addition to all land charges, will be made. There can be little doubt that business men on steamers, finding that they can communicate with land 100 miles out at sea, will be prone to use the system, and that the dissemination of important news on the vessel is likely to promote private messages.

With this system in vogue, it seems as if there should be a decided improvement in the security of ocean voyages. Vessels equipped with the wireless instruments may almost always be in touch with other ships on transatlantic voyages, and any trouble can at once be flashed through the air, communication being possible for at least 100 miles. Under these circumstances, any steamship that floats around disabled and lost to the world would do so simply because the owners of the vessel have neglected to equip her with the wireless system, and thus failed to take one of the most ordinary precautions against trouble and worry. Overdue vessels will be able to tell where they are and what has delayed them, so that anxiety may be allayed, and a call for help at sea from 100 miles away should rarely or never fail to be answered. Those who go down to sea in ships in the future are more than likely to ask questions in regard to the Marconi equipment, and it is by no means impossible that the system will be as important and necessary a part of an Atlantic liner as the propeller.

FIRST SUBMARINE FOR THE BRITISH NAVY.

The first of the five vessels of the submarine class, building after the Holland design, has recently been completed at the yards of the Vicker, Sons & Maxim, Barrow, England, and has attracted considerable attention. The torpedo boat Hazard has been commissioned for special service with the submarine. The boat just finished is a typical Holland boat and is 63 ft. 4 in. long, 11 ft. 9 in. wide and displaces, when submerged, 120 tons. The plating and frames are of steel of sufficient size and thickness to withstand the pressure of depths not over 100 ft. The bulkheads are located so as to provide safety in the event of collision and to stiffen the hull as a whole. Decks are provided throughout the entire length of the interior of the vessel, and are combined with beams and floors to carry the weight of machinery. The water tanks for the submersion are of steel, braced, stiffened, riveted and caulked absolutely tight. A superstructure is provided which serves as an above-water deck when the vessel is light for surface running. The deck is 31 ft. long, and on it are stowed anchors and lines; it also affords mooring facilities for the vessel. The conning tower is of armored steel, its outside diameter is 32 in., and its minimum thickness 4 in. It is provided with ports for observation and for navigation. The main engine is of the gasoline type, 160 H.P., for surface propulsion. The fuel supply allows of a maximum run of 400 knots, and its maximum speed on the surface is about 8 knots per hour. For underwater propulsion an electric motor is provided, giving the vessel a speed of 7 knots per hour submerged. The storage battery has a capacity for four hours at 7 knots per hour. The ballasting system consists of apparatus and means for quickly changing the vessel from the light to the diving condition or the reverse; automatic means of keeping displacement constant in different waters; means of compensation for variable weights installed, and all weights expended, such as torpedoes, etc. Compressed air is stored aboard the vessel and is used for breathing purposes when running submerged. Above-water ventilators provide for the circulation of outside air throughout the vessel. For steering and diving, engines are provided with automatic means of moving rudders to the desired positions, and automatic means of preventing the vessel from inclining to excessive angles during diving or rising, to keep the depth of submergence constant, to bring the vessel to a horizontal position at the desired depth, and to prevent diving to excessive depths. The armament consists of one torpedo expulsion tube, located at the extreme forward end of the vessel, and opening outward 2 ft. below the water line. The vessel carries five torpedoes, each 11 ft. 8 in. long.

A new suspension bridge will shortly be erected at Capertown, W. Va., by the John A. Roebling's Sons Co., Trenton, N. J. The new bridge will be what is known as the "all rope type of suspension bridge" and will be about 460 ft. span, 6 ft. wide, crossing New river on a level with the Chesapeake & Ohio railway tracks. The bridge will connect the two coal plants of the Victoria Coal & Coke Co. and the Chapman Coal & Coke Co.

The success, or lack of success, of propeller wheels is largely attributable to the care, or lack of care, in fitting the conditions of each particular case. Especial attention is given that very important subject by the Marine Iron Works, station A, Chicago, resulting in their being in receipt of many orders for propeller wheels within their range of sizes (18 in. to 6 ft.), and in the speed, cruising or towing patterns, as may be required. 6

A chart of Lake Erie in colors (engineer survey) has just been issued and may be had from the Marine Review.

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ORNAMENTS OF THE OLYMPIA.

The Olympia, flagship of Admiral George Dewey at the battle of Manila bay, now possesses probably the most beautiful stem and stern ornaments of any warship in the world. These pieces are already attached to the hull of the ship. The idea of commemorating the battle of May 1, 1898, by means of ornamenting the flagship of the squadron, which won the victory, originated with Naval Constructor William J. Baxter, head of the department of construction and repair at the Boston navy yard. He made known his views to the navy department and the plan met with approval from the authorities at the capital.

The undertaking was in a way unique, for only one ship in our navy has any such ornaments, and they are mostly of wood. This ship is the Cincinnati, and the ornaments are mostly of pine; only the bust, bow eagle, stern eagle and the boys being of bronze. The commission to design the Olympia pieces was given to Alvan C. Nye of New York city. The only limitations imposed upon him by the department were that there must be a figure on the bow, and the seal of the navy department introduced in some way. Many designs were made before deciding on the scheme submitted to the chief naval constructor for his approval. During the process of working out the design for the Olympia's bow, the arms of the United States were substituted for the seal of the department, at the suggestion of Mr. Baxter. The small United States shield in the Olympia designs is an improvement on the shield on the Cincinnati.

One difficulty in placing a figure on the bow of a ship is to arrange the hands and arms so that they do not project where they will be caught by lines and broken. In some instances the arms are not free, but are kept close against the body; in others they are extended in front with the hand near the forehead, the bow serving as a guard. Both of these forms are so common that it was found desirable to avoid them. The curved lines of the Olympia's bow seemed to call for an erect figure presenting a profile. Even after the stem ornament of the Olympia was in place it was found necessary to cut a new hawsepipe lower down on the side, in order that there may be no danger of chafing the fine scrollwork when the ship is at anchor in rough weather.

The new figure is a winged victory wearing the helmet and breastplate of Minerva, suggesting wisdom and courage. On her uplifted hands is poised an American eagle about to fly, suggesting freedom. The Victory stands on the head of an ornamental device called the dolphin, representing the sea. The whole composition may be interpreted as representing American freedom and victory gained by prudence, courage and perseverance. The trailing ornament explains itself. It is based on the historic Roman scroll. The bunch of acanthus leaves supporting the hawse-pipe serves as the starting point for the foliage which blossoms into a huge rosette (shield), on which are the arms of the United States.

The stern-piece is essentially a name-plate. As such it wraps closely against the hull. Its largest mass is a big cartouche with its edge scrolled. Everything is subordinate to this and of a decorative, symbolic nature. The crown is the spread eagle and shield. The decorative foliage develops into two boyish figures supporting helmets of Mars, thus suggesting the warlike nature of the ship.

The bow eagle is made entirely of bronze from the torpedo ports carried by the Olympia at Manila bay. The rest of the casting contains some of this metal, but there is also new metal mixed with it. The estimated weight of the bow eagle is 275 lbs. The whole ornament weighs about 2,500 lbs. The stern-piece weighs 1,400 lbs.

BATTLESHIP MISSOURI.

The battleship Missouri, building at the works of the Newport News Ship Building & Dry Dock Co., Newport News, Va., for the United States navy, will be launched on Saturday of this week. Miss Marion Cockrell, daughter of Senator Cockrell of Missouri, will christen the vessel. The Missouri is a sister to the Maine, building at Cramps, and the Ohio building at the Union Iron Works. The act of congress authorizing the building of the battleship Missouri was approved May 4, 1898, and the contract was executed Oct. 11, 1898. The contract price for the hull and machinery alone is $2,885,000 and the date of completion Aug. 30, 1901. The actual date of completion, however, will be governed entirely by the delivery of the armor at the ship yard. The vessel now building was based on the department's design as approved for a 16-knot vessel. Later her length was increased 20 ft. by the contractors to accord with the department's later decision in order to accommodate the increased power for 18 knots speed. The dimensions are as follows: Length of load water line, 388 ft.; breadth, extreme, 72 ft. 2½ in.; displacement at trial draught of 23½ ft., 12,500 tons; freeboard forward at the bow, 20 ft.; freeboard aft at the stern, 13 ft. The main battery will consist of four 12-in. breech-loading rifled guns and sixteen 6-in. rapid-fire guns. The 12-in. guns are to be installed in two Hichborn balanced turrets. Twelve of the 6-in. guns are mounted in broadside on the main deck. The remaining four 6-in. guns are mounted on the upper deck amidships on each side. The secondary battery consists of twenty 6-pounders, six 1-pounders and four Gatlings with one 3-in. rapid-fire field gun.

A chart of the Detroit river in colors—the best chart of the river ever printed—has just been issued from the Detroit engineer office. It takes in everything from Windmill point to Bar point. All the changes resulting from extensive dredging, shifting of ranges, etc., are very clearly shown, and the corrections are, of course, up to date. This chart may be had from the Marine Review.

J. H. Lawrence of Canton, N. Y., has just issued a very excellent catalogue devoted to his output of high-grade rowboats and canoes. It describes thoroughly the entire product of his yard.

The Portland Ship Building Co., Portland, Me., has just begun work upon a new wooden schooner.

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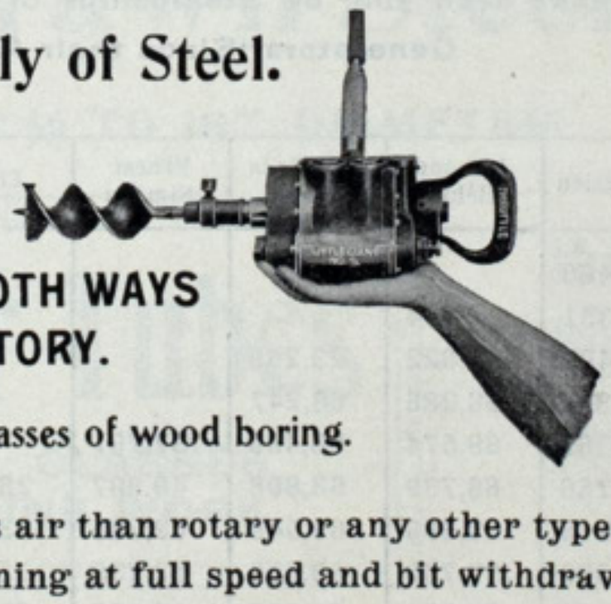

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PINTSCH GAS SYSTEM.

A statement recently published by the Safety Car Heating & Lighting Co. of New York shows the widespread operations of the different companies controlling the use of Pintsch gas and Pintsch gas burning apparatus throughout the world. This is the gas that is so well known to mariners on account of its use in lighted buoys. The New York company operates in the United States, Canada and Mexico. The statement which follows shows the number of railway cars, locomotives and buoys in which this gas was used on May 1, 1901:

	Cars.	Locomotives.	Gas Works.	Buoys and Beacons.
Germany	38,218	4,285	71	98
Denmark	45	....	3	21
England	18,611	18	87	272
France	6,618	....	27	240
Holland	3,318	5	10	83
Italy	1,528	....	5	15
Switzerland	380	2	1	....
Austria	3,777	....	10	1
Russia	2,845	102	13	13
Sweden	591	29	4	2
Servia	169	....	..	....
Bulgaria	98	....	1	....
Turkey	112	....	..	....
Egypt	2	....	3	112
Canada	75	....	2	60
Brazil	974	31	1	33
Argentine	1,046	....	10	2
Chili	46	....	2	....
India	8,058	....	16	....
Australia	2,053	....	13	29
United States	17,000	....	54	162
Japan	100	....	2	4
China	...	....	1	15
Total	105,664	4,472	336	1,162
Increase for the year	7,482	451	30	124

A Pintsch gas plant is now being erected in the City of Mexico.

SKETCH OF MR. PHILIP WATTS.

Last week it was announced in the Review that Mr. Philip Watts had been appointed to the post of director of naval construction of the British admiralty, replacing Sir William White, who retires on account of ill health. It is an interesting coincidence that when Sir William, then Mr. White, left Elswick for the admiralty, Mr. Watts left the admiralty for Elswick. Thus another interchange has taken place.

Mr. Philip Watts received his professional education in the naval service, entering Portsmouth dock yard in 1862 as an apprentice. He underwent what was then known as the superior course of training. He was sent as an admiralty pupil to the royal school of naval architecture and marine engineering, and on leaving it in 1870 he obtained the diploma of fellow of the school. For several years afterwards he was associated with the late Mr. William Froude, F. R. S., in the important experimental work which he had taken up for the admiralty, with a view to ascertaining the resistance of ships, and the best forms for ships, and settling kindred questions. In 1872 he was placed on the staff at the admiralty, where he continued for thirteen years, employed on the design of ships for the royal navy. When Sir William White was appointed director of naval construction in 1885, in succession to Sir Nathaniel Barnaby, Mr. Watts was chosen by Sir W. G. Armstrong, Whitworth & Co., Ltd., to occupy the post of naval architect and director of Elswick ship yard, vacated by Sir William White, and he has held that position down to the present time. During his stay at Elswick a very large number of warships of all classes has been built by him for foreign governments, and a considerable number for the British government. Amongst the latter may be mentioned the ill-fated Victoria; the protected cruisers Katoomba, Mildura and Wallaroo (destined for service in Australia); the cruisers Sirius and Spartan, and the Pactolus; the composite gunboats Rattler and Wasp; the gunboats Plassey and Assaye, and the Boomerang and Karrakatta; the torpedo boat destroyers Swordfish and Spitfire; and the ill-fated Cobra. At the present time the first-class cruiser Lancaster is in course of construction. Of the vessels built for foreign governments the most remarkable, and those in connection with which the Elswick firm has obtained a world-wide and well-deserved reputation, have been of the protected cruiser class. Mr. Watts has had an enormous experience, and being as he is in the prime of life, it is beyond question that he is eminently qualified for the position to which he has just been appointed.

The Atlantic Works, Incorporated, of Philadelphia recently shipped one of their band saw setting and filing machines to the Baltimore Dry Dock Co., Locust Point, Baltimore, Md.

Package Freight Apparatus.

For Sale—A complete equipment of modern package freight hoisting machinery now on steamer Selwyn Eddy. For particulars apply to Brown & Co., Buffalo, N. Y. Jan. 23.

Steam Yacht For Sale.

For Sale—Steam yacht Helen, built in 1895. H. Houghten, Detroit, Mich. Dec. 26.

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Year.	Australien	Polynésien	Armand Béhic	Ville de la Ciotat	Ernest Simons	Chili	Cordillère	Laos	Indus	Tonkin	Annam	Atlantique
1890	67,728	2,460										
1891	68,247	68,331	204									
1892	68,247	68,403	69,822	23,259								
1893	68,379	68,343	68,286	68,247								
1894	68,439	68,367	68,574	68,439	37,701							
1895	68,673	68,766	68,739	68,808	40,887	28,713						
1896	69,534	92,718	69,696	69,549	62,205	63,153	40,716					
1897	68,250	69,606	92,736	69,555	62,235	76,110	63,357	43,146				
1898	70,938	69,534	69,552	69,597	62,526	63,240	63,240	62,553	63,954	22,707		
1899	69,534	69,615	67,431	90,405	60,246	62,778	62,868	52,344	54,855	44,007	22,884	
1900	69,534	67,494	69,744	69,564	61,719	62,382	62,502	51,471	53,373	62,016	63,066	52,140
Total	757,503	713,637	644,784	597,423	387,519	356,376	292,683	209,514	172,182	128,730	85,950	52,140

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WANTED—MACHINERY FOR A FIRE BOAT.

Office of the Board of Public Works, Milwaukee, December 10, 1901. Sealed proposals will be received at this office until Friday, January 10, 1902, at 10:30 o'clock A. M., for furnishing the propelling engine and its appurtenances, the steam fire pumps and the Scotch marine boilers for a new steel fire boat for the city of Milwaukee, according to plans and specifications on file in this office. Bidders desiring plans and specifications will be required to deposit the sum of $50.00 as a guarantee for the safe return of the same. For further particulars, apply to the Board of Public Works, Milwaukee, Wis., or to W. J. Wood, Naval Architect, 269 Fifth Avenue, Chicago, Ill. Jan. 9.

Treasury Department, U. S. Life-Saving Service, Washington, D. C., December 17, 1901. Sealed proposals will be received at this office until 2:00 o'clock P. M., of Tuesday, January 7, 1902, and then publicly opened, for the construction of foundations, retaining walls, etc., for a life-saving station at Buffalo, New York. Specifications and drawings, forms of proposal, etc., can be obtained upon application to the Superintendents of Construction of Life-Saving Stations, 17 State Street, New York City; to the Superintendent of the 10th Life-Saving District, Custom House, Buffalo, New York; to the Assistant Inspector 10th and 11th Life-Saving Districts, Room 204 Postoffice Building, Detroit, Michigan; to the Keeper of the Cleveland Life-Saving Station, Cleveland, Ohio; or to this office. S. I. Kimball, General Superintendent. Dec. 26.

Passenger Steamer, Sale or Charter.

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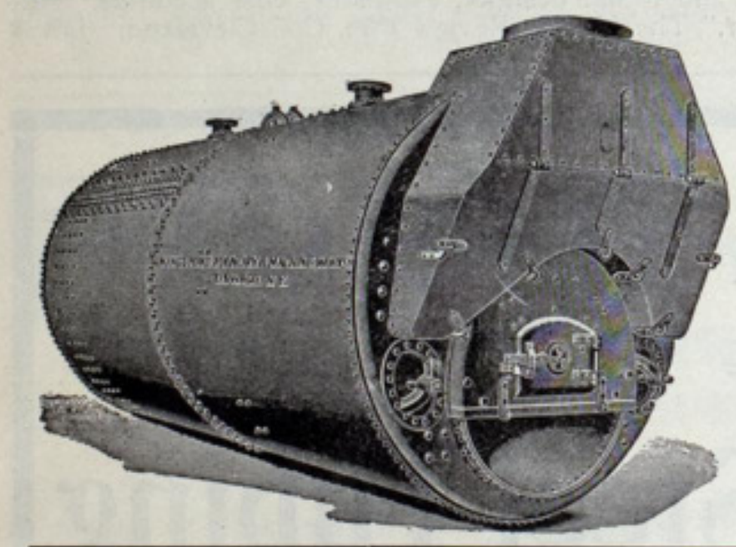

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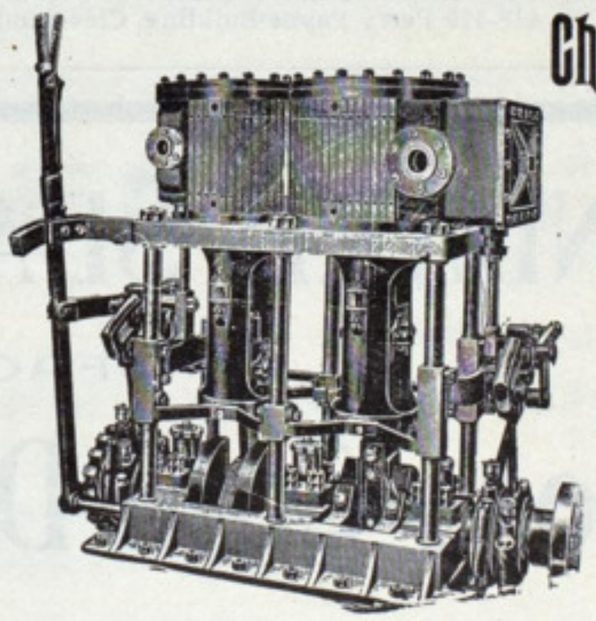

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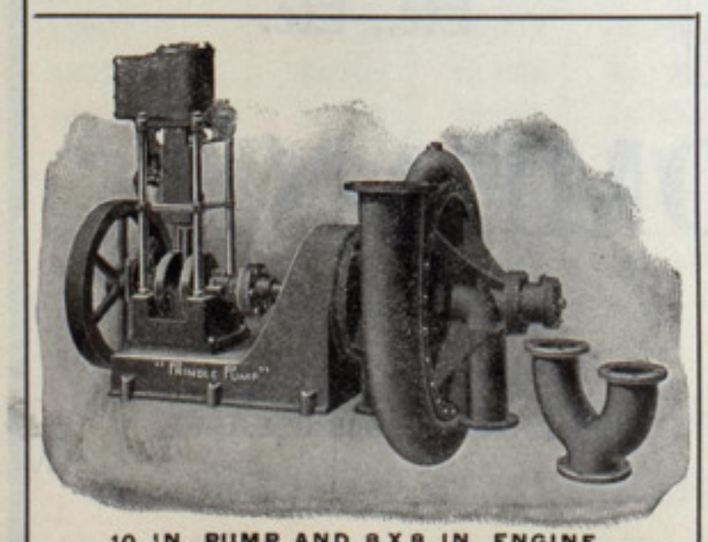

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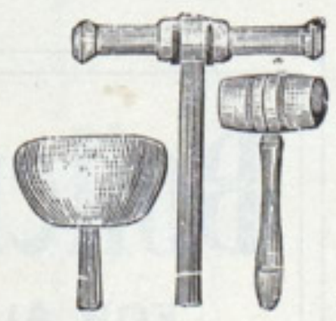

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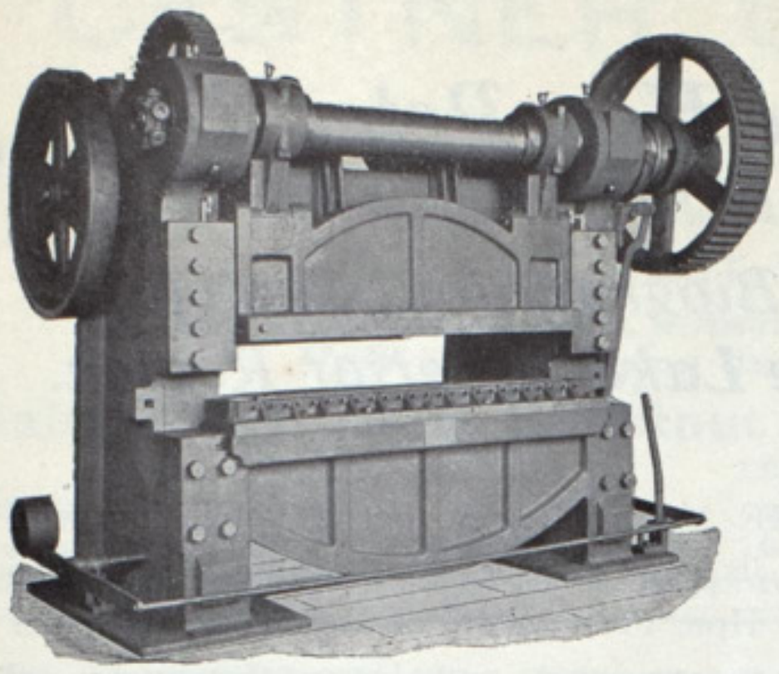

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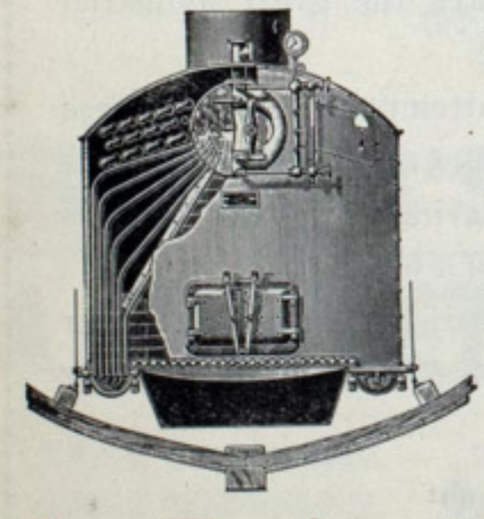

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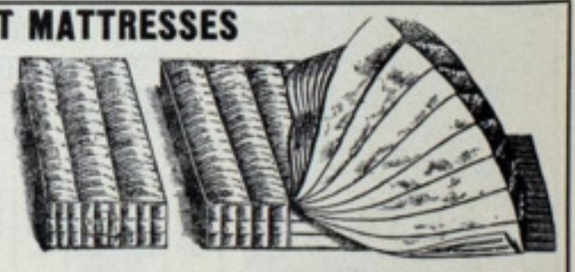

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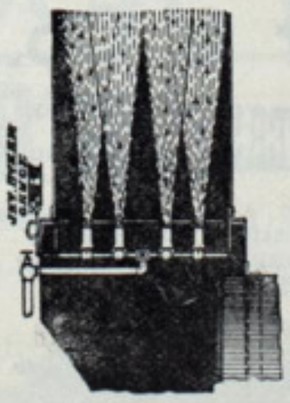

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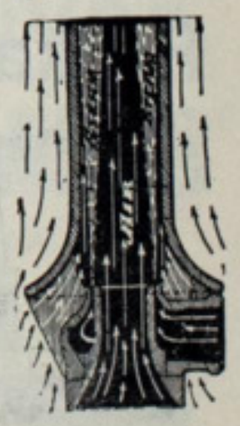

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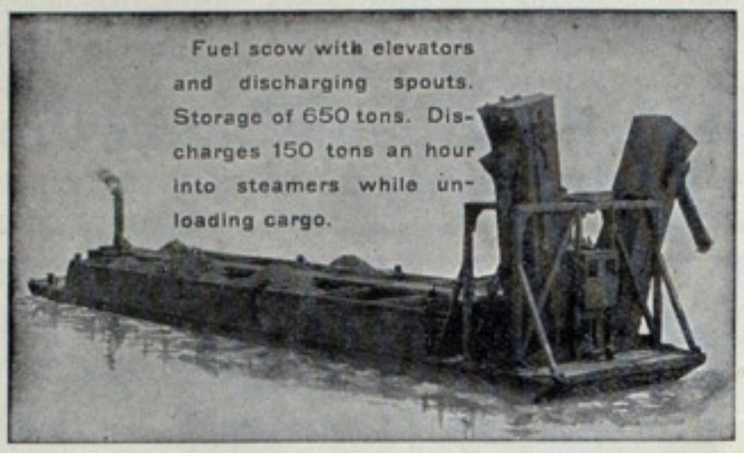

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There will be much published that has never been told. Many facts will be brought out which make strange reading today, but which are nevertheless incontestible. The actual manuscripts of men, living and dead, having to do with the making of this country, have been examined, and what is interesting has been taken from them.

Fiction does not offer anything as fascinating as this tale of the men who did. The whole story revolves about the Hon. Peter White, because he is the only man whose life encompasses all of it. He was there in the beginning and he is there yet. His advent in the iron region was right upon the heels of the men who actually discovered the iron deposits.

With about 20,000,000 tons of ore tumbling annually upon the docks on Lake Erie, the great gateway to the furnaces, it seems odd that 1,000 tons should ever have been regarded as an avalanche. Yet it is not so very long since 1,000 tons per annum represented the utmost output of a struggling company in the Lake Superior region.

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Hale Rubber Co., Alfred.....So. Boston, Mass.
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DRILL PRESSES—DRILLS OF ALL KINDS.

Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

DRILLS, PNEUMATIC.

Standard Pneumatic Tool Co.....Chicago.

DRYING APPARATUS.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Sturtevant, B. F. Co.....Boston.

DRY DOCKS.

American Ship Building Co.....Cleveland.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Chip Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Harlan & Hollingsworth Co.....Wilmington, Del.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Shipowners Dry Dock Co.....Chicago.
Standard Ship Building Co.....Perth Amboy, N. J.

ELECTRIC LIGHT AND POWER PLANTS.

Badt-Goltz Engineering Co.....Chicago.
Buffalo Forge Co.....Buffalo.
Electro-Dynamic Co.....Philadelphia.
Elwell-Parker Electric Co.....Cleveland.
Fort Wayne Electric Works.....Fort Wayne, Ind.
General Electric Co.....Schenectady, N. Y.
Seidler-Miner Electric Co.....Detroit.
Sturtevant, B. F. Co.....Boston.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC HOISTS AND CRANES.

Elwell-Parker Electric Co.....Cleveland
Fort Wayne Electric Works.....Fort Wayne, Ind
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa

ELECTRIC STEERING GEAR, SPEED AND RUDDER INDICATORS, ETC.

Electro-Dynamic Co.....Philadelphia.

ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lake Shore Engine Works.....Marquette, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Mosher, Chas. D.....New York.
Neafie & Levy Ship & Engine Building Co..Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Olds Motor Works.....Detroit.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mnfg. Co.....Milwaukee.
Standard Ship Building Co.....Perth Amboy, N. J.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Willard, Chas. P. & Co.....Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
Electro-Dynamic Co.....Philadelphia.
Seidler-Miner Electric Co.....Detroit.

ENGINEERING SPECIALTIES AND SUPPLIES.

Crane Co.....Chicago.
Kieley & Mueller.....New York.
Reilly Repair & Supply Co., James.....New York.

ENGINEERS, MARINE AND MECHANICAL.

Cook, Geo. Crouse.....New York.
Electro-Dynamic Co.....Philadelphia
Gaskin, Edward.....Buffalo.
Holmer & Goodenough.....New York.
Hunt, Robt. W. & Co.....Chicago
Miller, Walter.....Cleveland.
Mosher, Chas. D.....New York.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.
Powell, Ambrose V.....Chicago.
Roelker, H. B.....New York.
See, Horace.....New York.
Wood, W. J.....Chicago.

EVAPORATING AND DISTILLING APPARATUS.

Reilly Repair & Supply Co., James.....New York.

FANS FOR VENTILATION, EXHAUST, ETC.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.
Reilly Repair & Supply Co., James.....New York.
Smith, W. Blackburn.....Perth Amboy, N. J.

FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

FORGES.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.

Cleveland City Forge & Iron Co.....Cleveland.
Fore River Ship & Engine Co.....Quincy, Mass.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

FUELING COMPANIES AND COAL DEALERS.
Castner, Curran & Bullitt (Pocahontas)....Philadelphia.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Smith, Stanley B. & Co.....Detroit.
Youghiogheny & Lehigh Coal Co.....Chicago.

GAS BUOYS.
Safety Car Heating & Lighting Co.....New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.
Lake Shore Engine Works.....Marquette, Mich.
Olds Motor Works.....Detroit.

GAGES, STEAM AND VACUUM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

GRAPHITE BUSHINGS AND BEARINGS.
Graphite Lubricating Co.....Bound Brook, N. J.

HAMMERS, PNEUMATIC.
Standard Pneumatic Tool Co.....Chicago.

HAMMERS, STEAM.
Bement, Miles & Co.....Philadelphia.
Chase Machine Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

HATCH GEARS.
"Long Arm" System Co.....Cleveland.

HAWSERS, WIRE.
American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co., Incorporated..Cleveland.
Chase Machine Co.....Cleveland.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
Marine Iron Co.....Bay City.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

HOSE FOR PNEUMATIC TOOLS.
Sayen & Schultz.....Philadelphia.

HYDRAULIC MACHINERY.
Bement, Miles & Co.....Philadelphia.
Watson-Stillman Co., The.....New York.
Wood & Co., R. D.....Philadelphia.

ICE MACHINERY.
Roelker, H. B.....New York.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

INJECTORS.
Crane Co.....Chicago.
Jenkins Bros.....New York.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Tandy, Frank N.....Boston.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

LAUNCHES—NAPHTHA, ELECTRIC.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

LOGS.
Walker & Sons, Thomas.....Birmingham, Eng.
Also Ship Chandlers.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.
Fay & Egan Co., J. A.....Cincinnati.

MACHINE TOOLS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

MALLETS FOR CAULKERS, BOILER MAKERS, ETC.
N. Y. Mallet & Handle Works.....New York.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.
Lein, Irvine & Co.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Blower Co.....Detroit.
American Ship Building Co.....Cleveland.
Bloomsburg & Co., H.....Baltimore, Md.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston.

MILLING MACHINES OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAUTICAL SCHOOL.
Chicago Nautical School.....Chicago.

NAVAL ARCHITECTS.
Cook, Geo. Crouse.....New York.
Gaskin, Edward.....Buffalo.
Holmer & Goodenough.....New York.
Mosher, Chas. D.....New York.
See, Horace.....New York.
Wood, W. J.....Chicago.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Crane Co.....Chicago.
Garlock Packing Co.....Palmyra, N. Y.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
Sayen & Schultz.....Philadelphia.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.
Fay & Egan Co., J. A.....Cincinnati.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.
Crane Co.....Chicago.

PLANERS OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc.....Philadelphia.
Fay & Egan Co., J. A.....Cincinnati.

PLATE BENDING AND PLANING MACHINES.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

PLUMBING, MARINE.
Reilly Repair & Supply Co., James.....New York.
Sands, Alfred B. & Son.....New York.

PNEUMATIC TOOLS.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.

POWER DOORS AND HATCHES.
"Long Arm" System Co.....Cleveland.

PRESSURE REGULATORS.
D'Este Co., Julian.....Boston.
Kieley & Mueller.....New York.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B .....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roelker, H. B.....New York.
Sheriffs Mnfg. Co.....Milwaukee.
Standard Ship Building Co.. .....Perth Amboy, N. J.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.
Badt-Goltz Engineering Co.....Chicago.
Elwell-Parker Electric Co.....Cleveland.
Fort Wayne Electric Works.....Fort Wayne, Ind.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Kingsford Foundry & Machine Works....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REFRIGERATING APPARATUS.
American Linde Refrigeration Co.....New York.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.
Cleveland Rivet & Forging Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER GOODS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

RUBBER INSULATED WIRES.
American Steel & Wire Co.....Chicago.
Roebling's Sons, John A.....New York and Cleveland.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SEARCH LIGHTS.
Badt-Goltz Engineering Co.....Chicago.
Elwell-Parker Electric Co.....Cleveland.
Fort Wayne Electric Works.....Fort Wayne, Ind.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Standard Ship Building Co.. .....Perth Amboy, N. J.
Trigg, Wm. R. Co.....Richmond, Va.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Moran Bros. Co.....Seattle, Wash.
Reilly Repair & Supply Co., James.....New York.
Upson-Walton Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

SOUNDING APPARATUS.
Farr, C. W.....Chicago.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Cleveland & Buffalo Transit Co.....Cleveland.
Clyde Line.....New York.
Dominion Line.....Boston.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL CASTINGS.
Seaboard Steel Casting Co.....Chester, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

SUBMARINE DIVING APPARATUS.
Hale Rubber Co., Alfred.....So. Boston, Mass.
Schrader's Son, A.....New York.

SURVEYORS, MARINE.
Holmer & Goodenough.....New York.
Gaskin, Edward.....Buffalo.
See, Horace.....New York.
Wood, W. J.....Chicago.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.
Standard Pneumatic Tool Co.....Chicago.
Watson-Stillman Co.....New York.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Atlantic Works, Inc.....Philadelphia.
Fay & Egan Co., J. A.....Cincinnati.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

TRAPS, STEAM.
D'Este Co., Julian.....Boston.
Haines Co., Wm. S.....Philadelphia.
Kieley & Mueller.....New York.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.
Benedict & Burnham Mnfg. Co.....Waterbury, Conn
Standard Seamless Tube Co.....Pittsburg.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crane Co.....Chicago.
Crosby Steam Gage & Valve Co.....Boston.
D'Este Co., Julian.....Boston.
Jenkins Bros.....New York.
Kieley & Mueller.....New York.
Wood & Co., R. D.....Philadelphia.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago
Hall & Root.....Buffalo.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Kennedy, Hunter & Co.....Antwerp.
Mitchell & Co.....Cleveland.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Tandy, Frank N.....Boston.

VENTILATING APPARATUS FOR SHIPS.
American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Atlantic Works, Inc.....Philadelphia.
Fay & Egan Co., J. A.....Cincinnati

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

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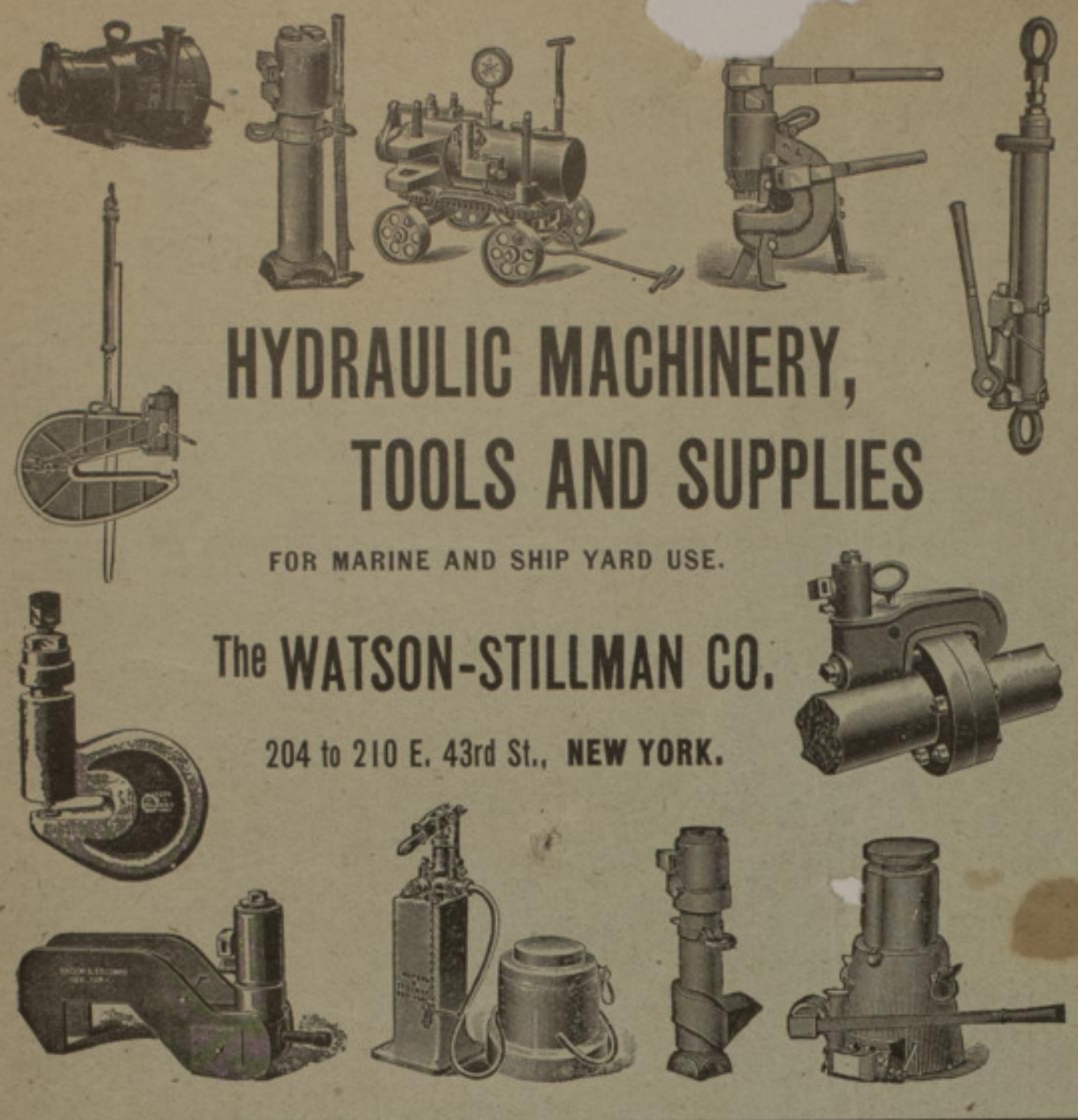

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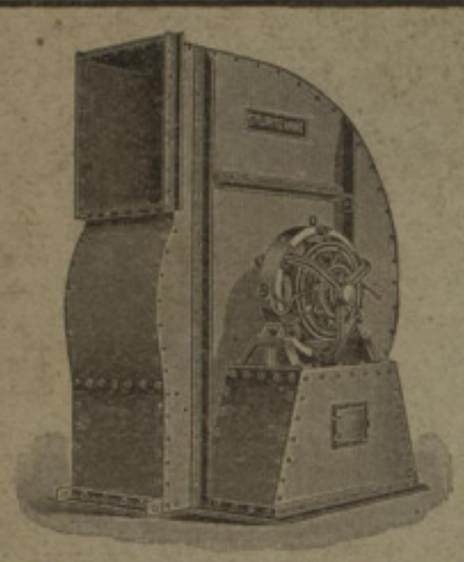

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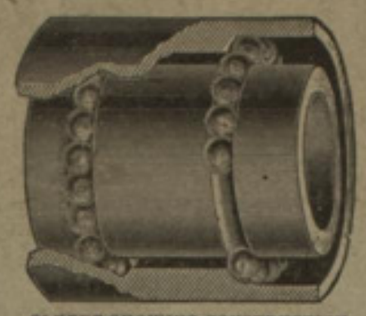

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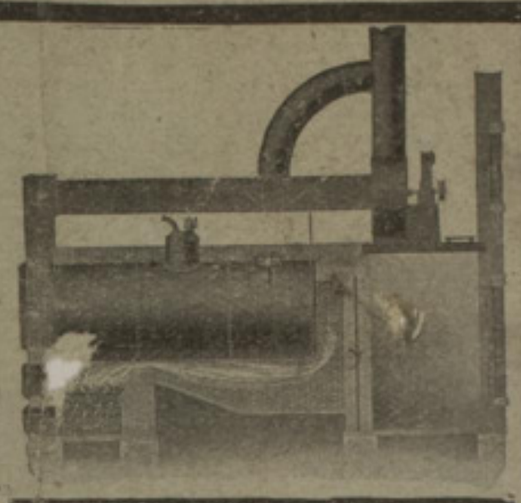

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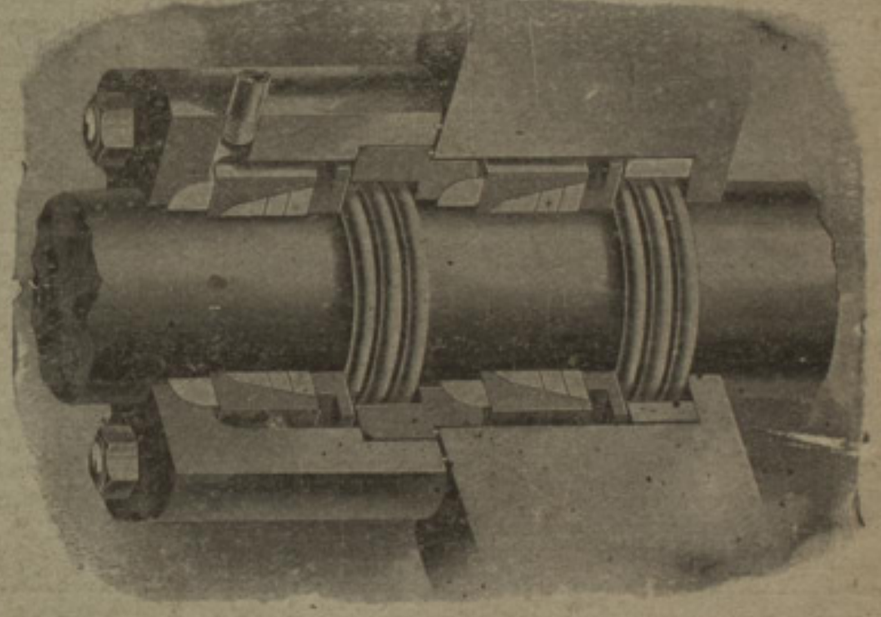

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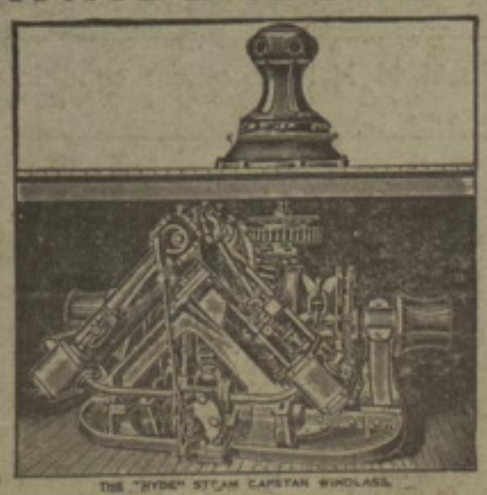

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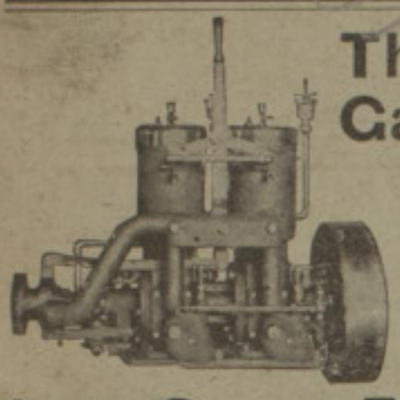

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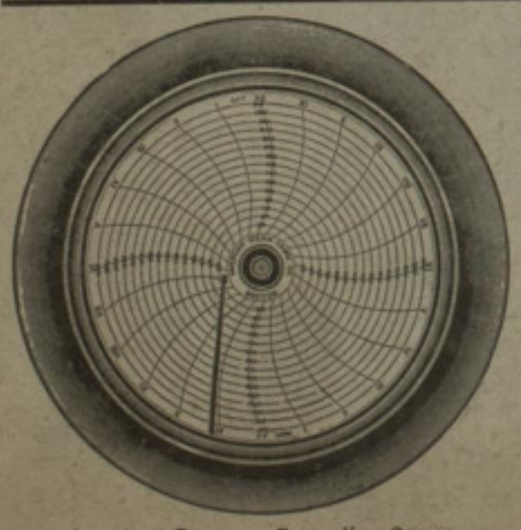

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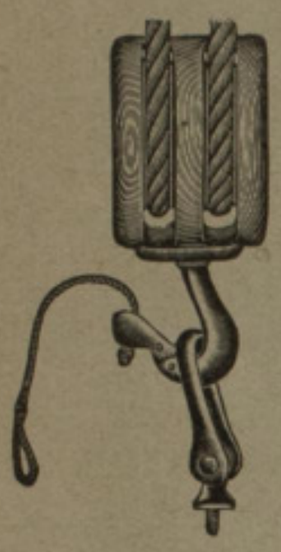

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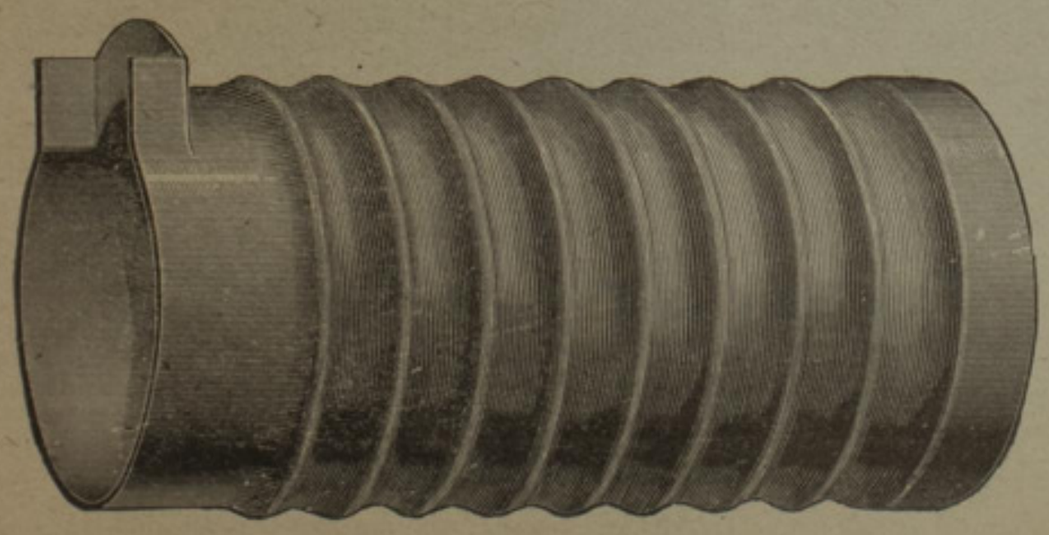

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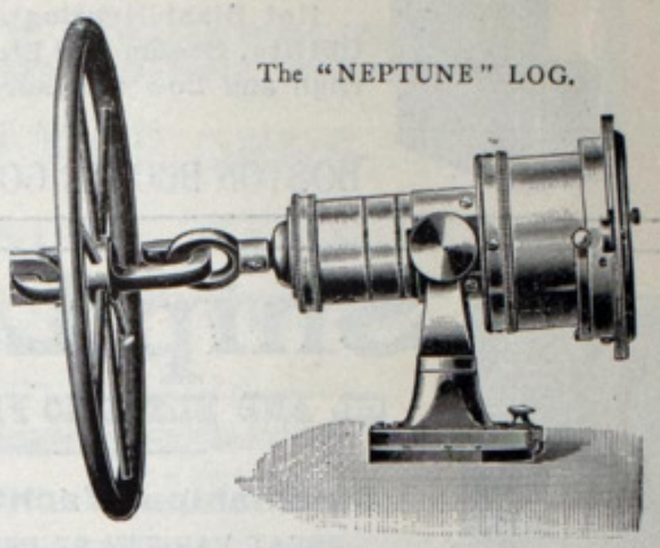

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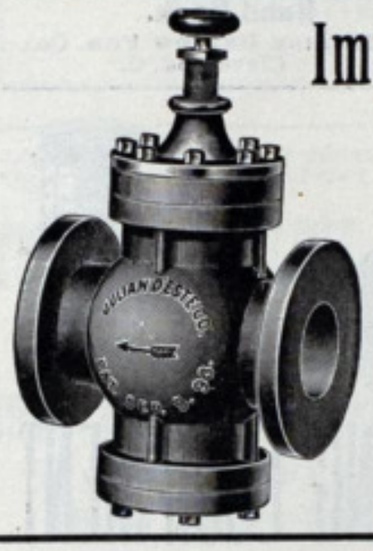

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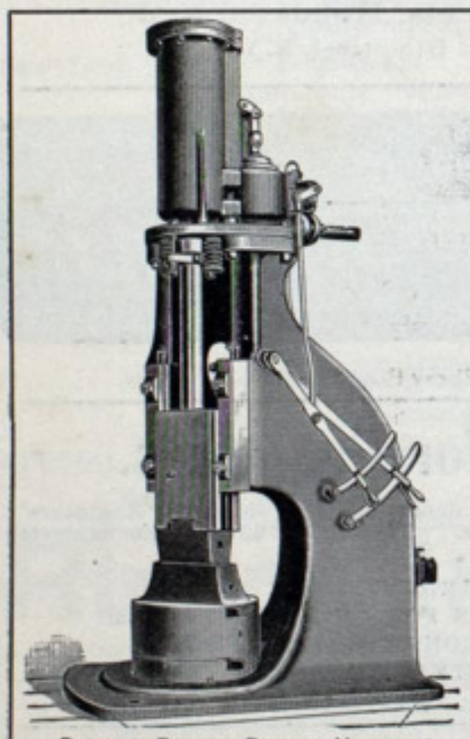

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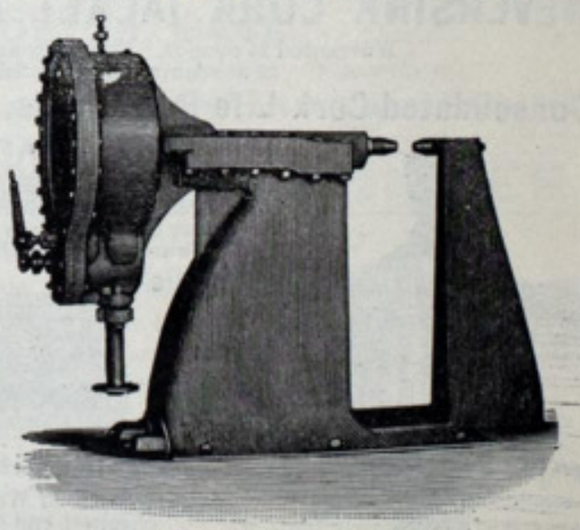

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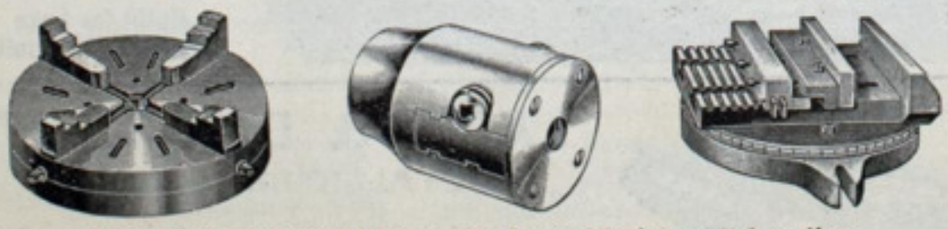

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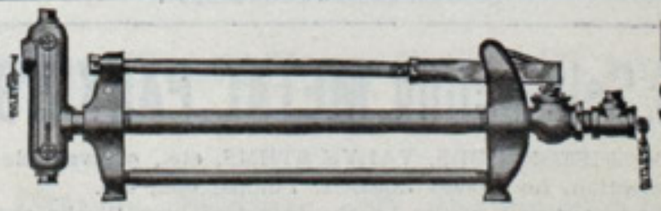

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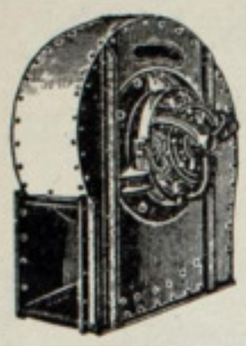

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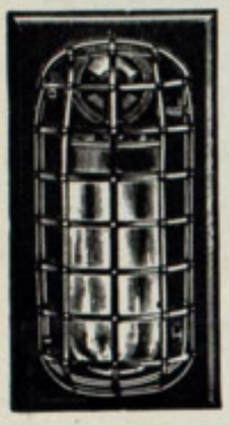

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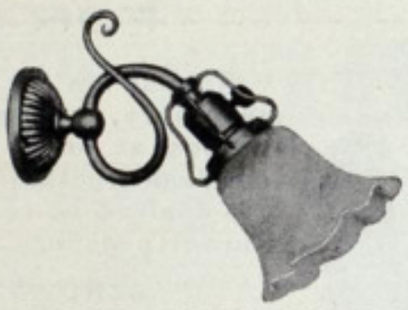

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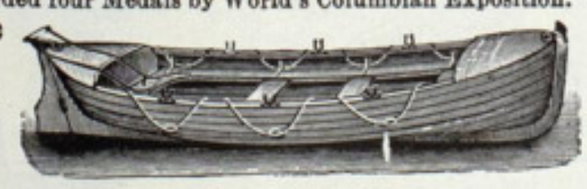

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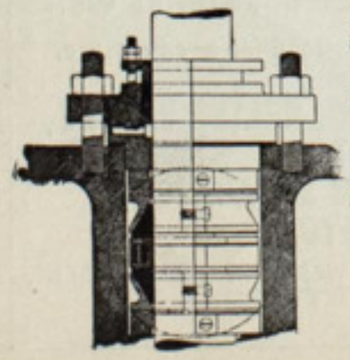

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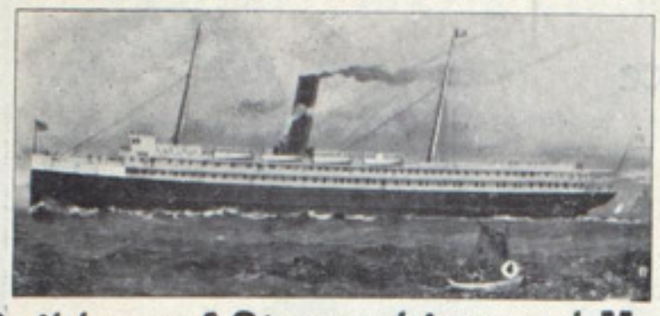

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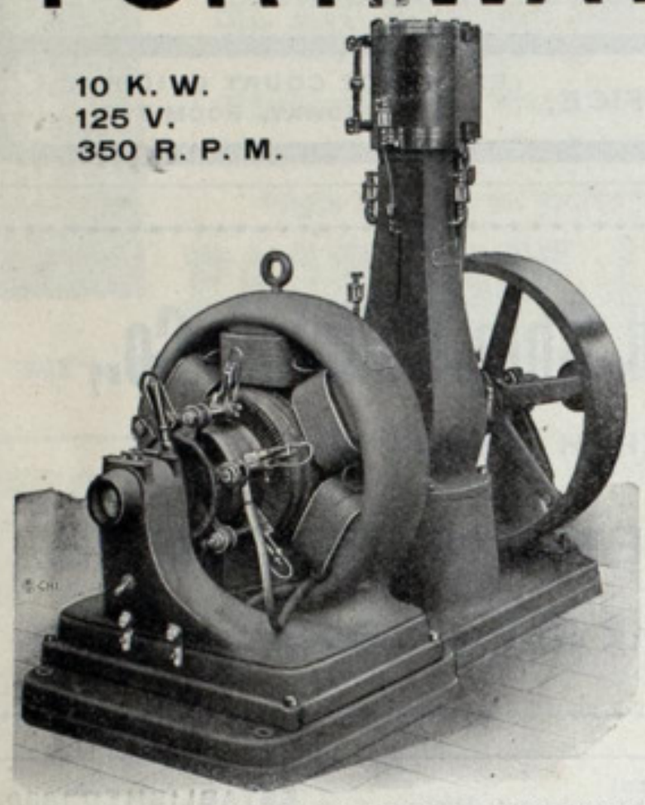

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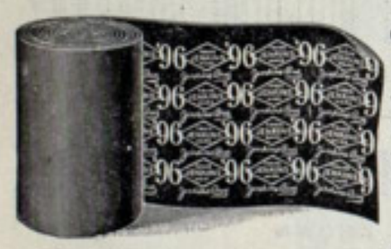

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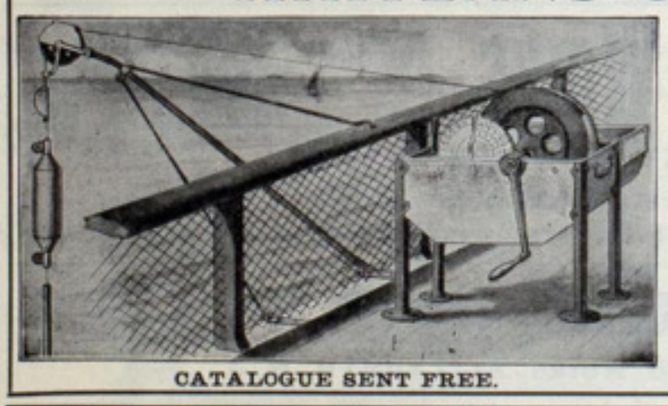

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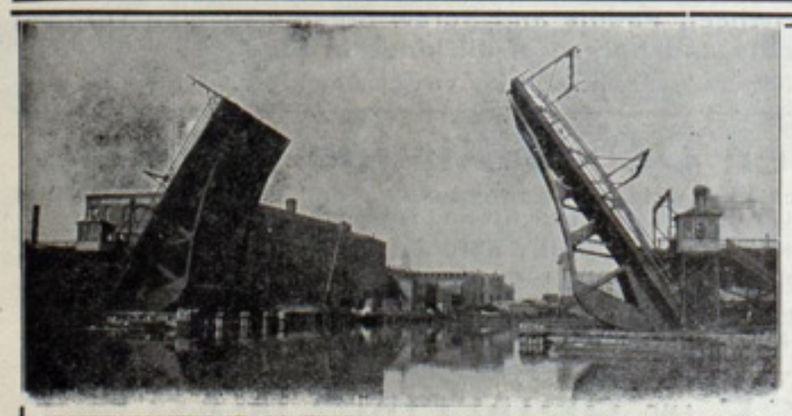

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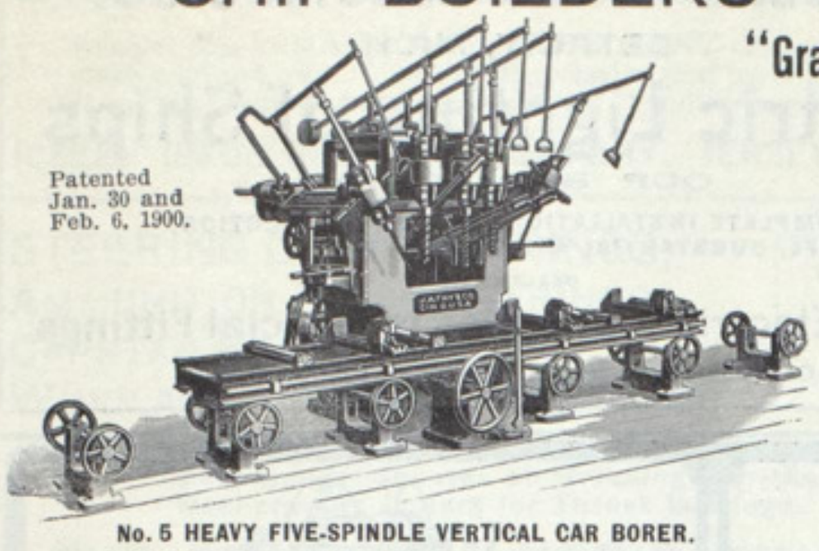

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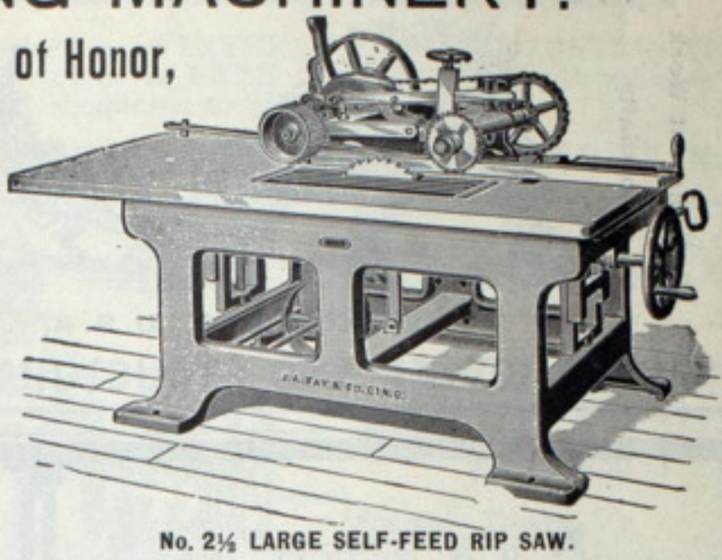

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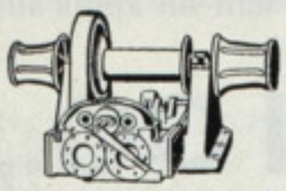

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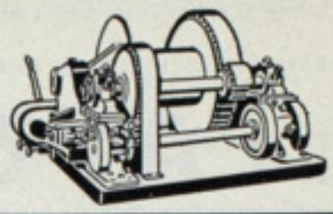

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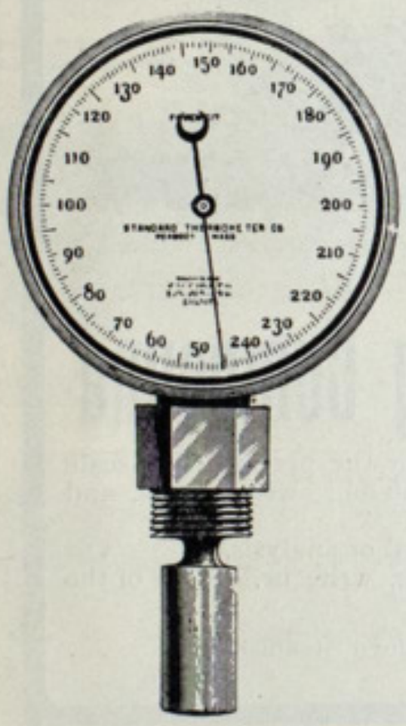

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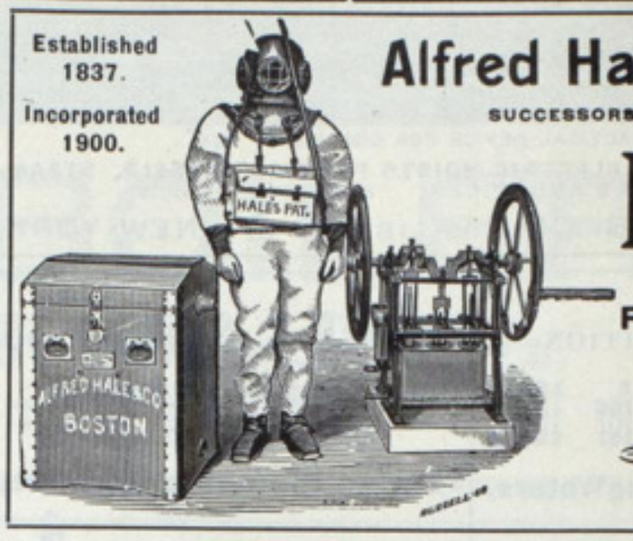

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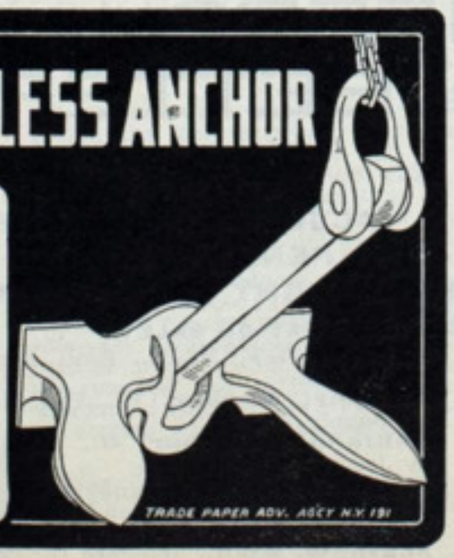

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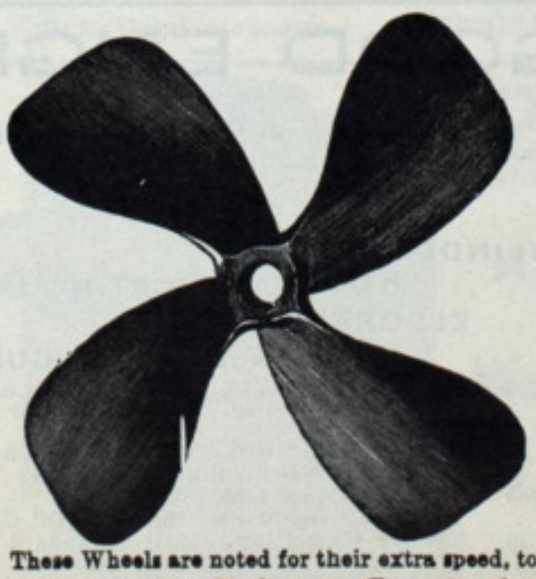

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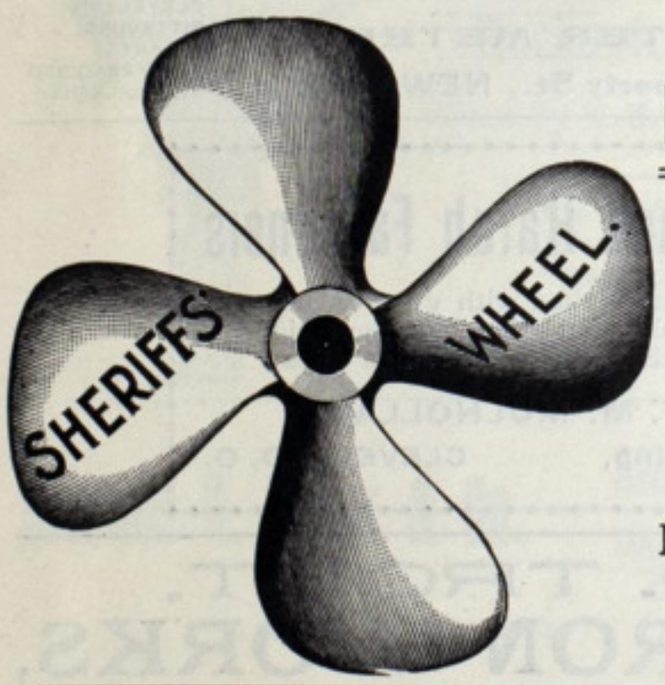

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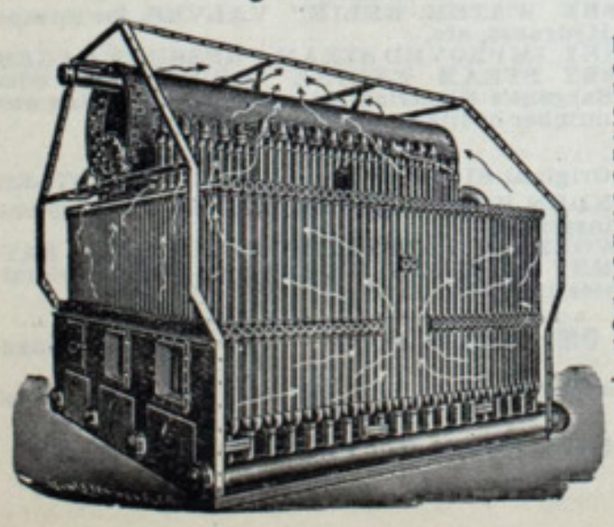

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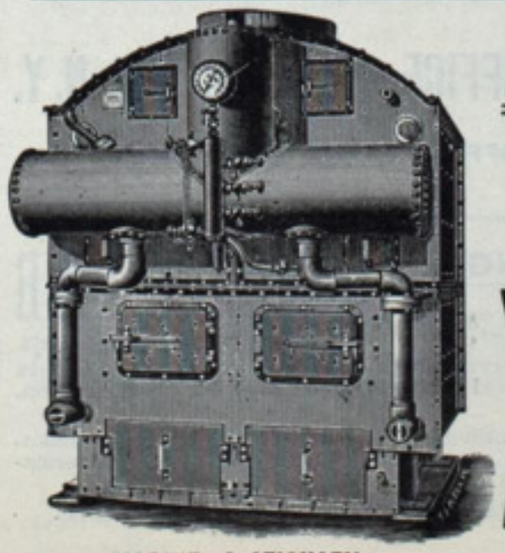

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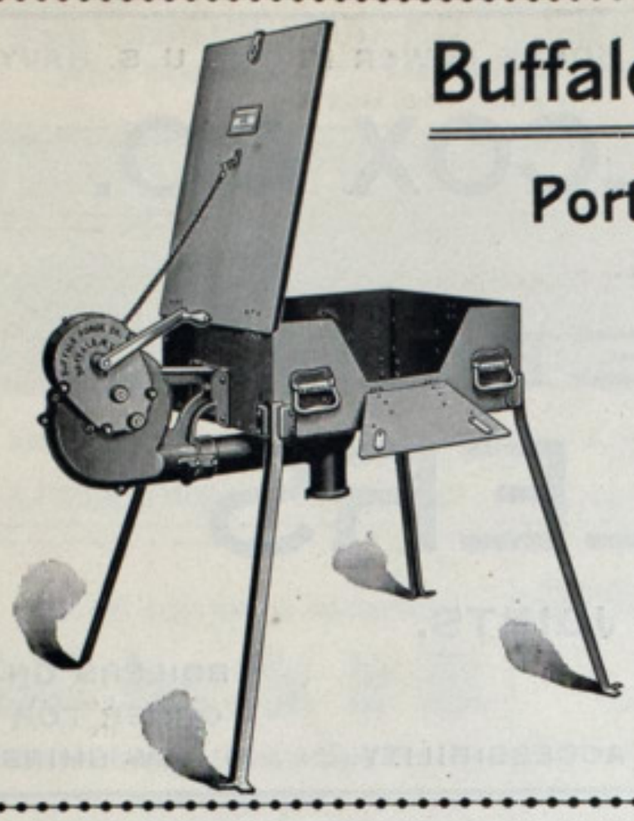

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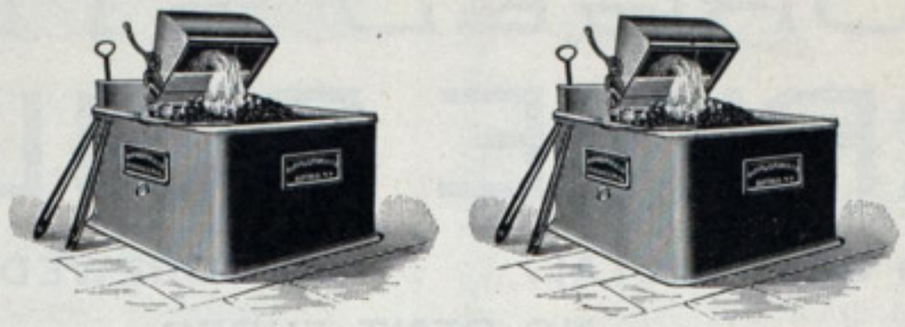

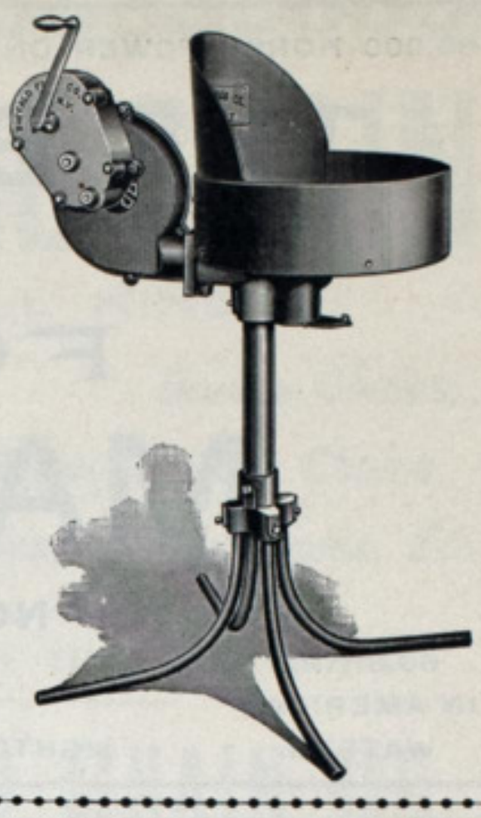

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